VOLUME 41 NUMBER 6

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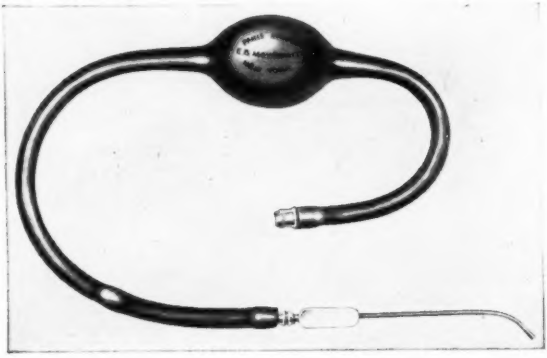

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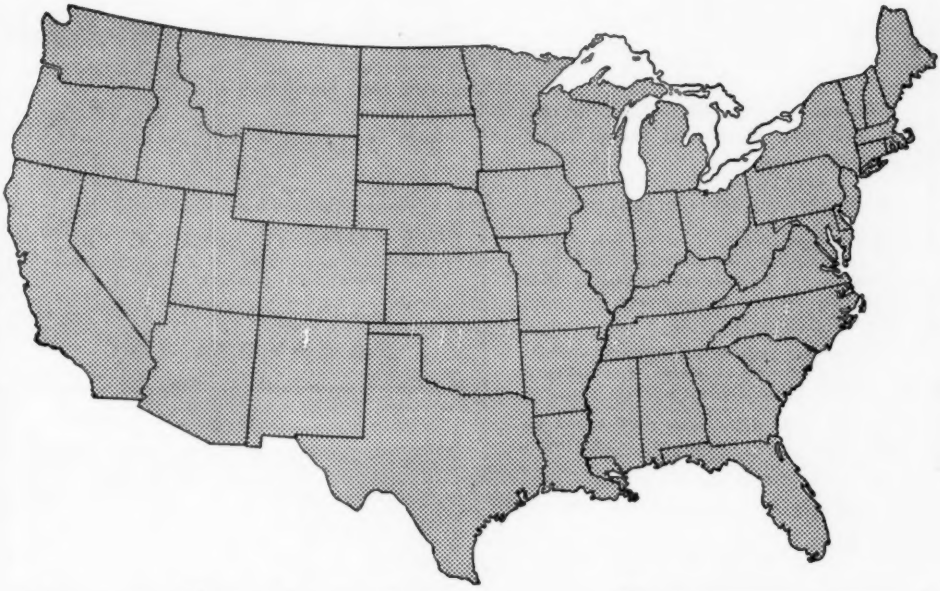

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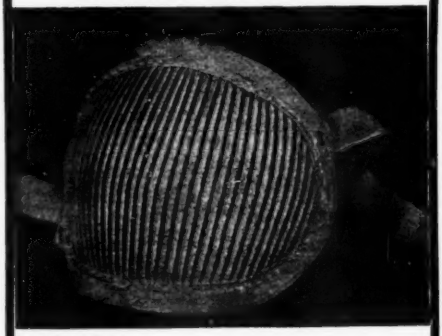

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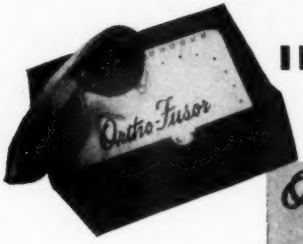

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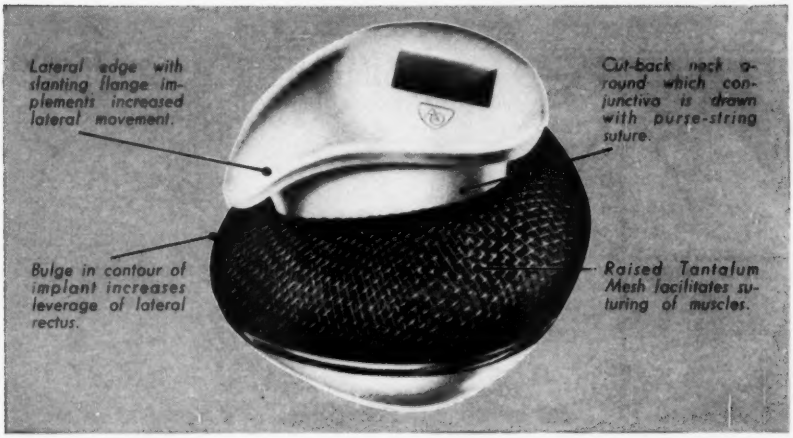
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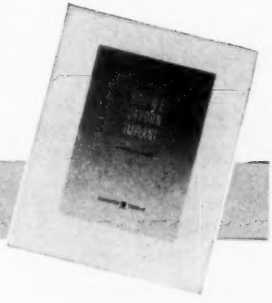

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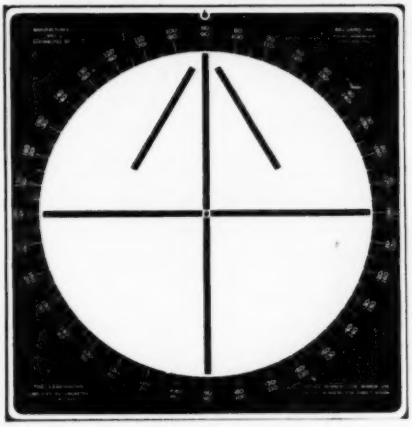

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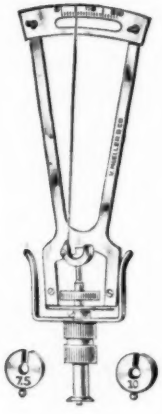

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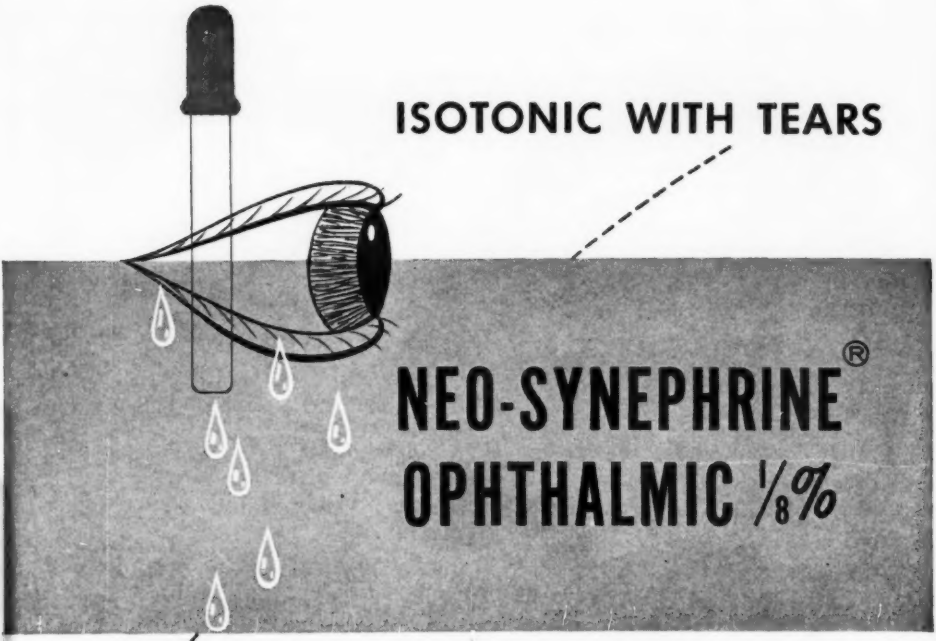

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BLOOD GROUPS AND EFFECTS OF ROENTGEN IRRADIATION IN RETROLENTAL FIBROPLASIA

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RETROLENTAL fibroplasia is a condition usually occurring bilaterally in premature infants and unilaterally in full term infants. It is characterized by a gray pupillary reflex; retrolental vascular membrane; microphthalmos; shallow anterior chamber, with anterior synechias, a feature which predisposes the eye to the development of secondary glaucoma; remains of an anterior pupillary membrane; spheroidal lens, and searching nystagmus. All the babies in the present series have deep-sunken eyes and a discoloration of the lids, such as is noted in adults after prolonged exertion without proper rest.

I shall report 12 cases of retrolental fibroplasia. I have studied the blood groups in 6 of these 12 cases, including those of the mothers and fathers and determined the Rh factor for each baby. Several infants were given roentgen radiation, the total dose ranging from 400 to 1,000 r, in an attempt to devascularize the membrane.

The first reference to this condition that I could find was made by Howard,[1] in 1852. Since then the various clinical and pathologic aspects of the lesions have been described under various synonyms, among which are the following: persistent thickened hyaloid artery with secondary changes (Nettleship,[2] 1873), persistent hyaloid canal and artery (Gardiner,[3] 1880), persistence and thickening of the posterior fibrovascular sheath of the lens (Collins,[4] 1892; Pollock,[5] 1923), atypical development of the anterior part of the vitreous with or without per-

From the Department of Surgery, Section of Ophthalmology, Strong Memorial Hospital of the University of Rochester School of Medicine and Dentistry, Rochester, N. Y.

1. Howard, H.: Further Proof of the Vascularity of the Lens and Its Capsule, Brit.-Am. J. Med. & Phys. Sc. **7**:150-153, 1852.

2. Nettleship, E.: Vascular Cord Traversing Vitreous and Coexisting with Great Plastic Inflammation of Hyaloid, Ophth. Hosp. Rep. **7**:632-637, 1873.

3. Gardiner, E. J.: A Case of Persistent Hyaloid Canal and Artery, Arch. Ophth. **9**:473-474, 1880.

4. Collins, E. T.: Pseudoglioma, Ophth. Hosp. Rep. **13**:361-394, 1892.

5. Pollock, W. B. I.: Case of Pseudoglioma Due to Persistent Thickening of the Posterior Fibrovascular Sheath of the Lens, Tr. Ophth. Soc. U. Kingdom **43**:263-272, 1923.

sistence of the hyaloid artery (Collins,[4] 1892), congenital membrane behind the lens (Parsons,[6] 1902), persistence of remains of the tunica vasculosa lentis (Brückner,[7] 1907), persistent posterior fibrovascular sheath of the lens (Lane,[8] 1919), persistence of the embryonic fibrovascular sheath of the crystalline lens (Lent and Lyon,[9] 1922) remains of the tunica vasculosa lentis (Gifford,[10] 1923), pseudo phakia fibrosa of Czermak (Lloyd,[11] 1931), opaque membrane behind the lens (Fuchs,[12] 1923), shrunken fibrous tissue cataract (Collins and Mayou,[13] 1925), posterior lenticonus (Collins and Mayou,[13] 1925), congenital connective tissue formation in the vitreous chamber (Collins and Mayou,[13] 1925), posterior polar cataract (Collins and Mayou,[13] 1925), persistent vascular sheath of the lens (Mann,[14] 1937), fibroblastic overgrowth of persistent tunica vasculosa lentis (Duke-Elder [15]), retrolental fibroplasia (Terry,[16] 1942, 1943 and 1945), persistent primary vitreous (Reese and Payne,[17] 1946).

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6. Parsons, J. H.: Microscopical Section of Pseudoglioma Due to Congenital Membrane Behind the Lens, Tr. Ophth. Soc. U. Kingdom **22**:253-354, 1902.

7. Brückner, A.: Ueber Persistenz von Resten der Tunica vasculosa lentis, Arch f. Augenh. **56**:5-149, 1907.

8. Lane, F.: Persistent Posterior Fibrovascular Sheath of Lens, Arch. Ophth. **48**:572, 1919.

9. Lent, E. J., and Lyon, M. B.: Persistence of Embryonic Fibrovascular Sheath of Crystalline Lens, Am J. Ophth. **5**:706-711, 1922.

10. Gifford, S. R.: Pseudoglioma and Remains of Tunica Vasculosa Lentis, Am. J. Ophth. **6**:565-571, 1923.

11. Lloyd, R. I.: Pseudoglioma, with Especial Reference to Type Associated with Remains of Tunica Vasculosa Lentis, Am. J. Ophth **14**:27-33, 1931.

12. Fuchs, E.: Text-Book of Ophthalmology, ed. 7, Philadelphia, J. B. Lippincott Company, 1923, p. 650.

13. Collins, E. T., and Mayou, M. S.: Pathology and Bacteriology of Eye, ed. 2, Philadelphia, The Blakiston Company, 1925, p. 45.

14. Mann, I.: Developmental Abnormalities of the Eye, New York, The Macmillan Company, 1937, p. 350.

15. Duke-Elder, W. S.: Text-Book of Ophthalmology, St. Louis, C. V. Mosby Company, 1938, vol. 2, p. 1381.

16. Terry, T. L.: Fibroblastic Overgrowth of Persistent Vasculosa Lentis in Infants Born Prematurely: Studies in Development and Regression of Hyaloid Artery and Tunica Vasculosa Lentis, Am. J. Ophth. **25**:1409-1423, 1942; Extreme Prematurity and Fibroblastic Overgrowth of Persistent Vascular Sheath Behind Each Crystalline Lens: Preliminary Report, ibid. **25**:203-204 and 262-284, 1942; Fibroblastic Overgrowth of Persistent Tunica Vasculosa Lens in Premature Infants: Etiologic Factors, Arch Ophth. **29**:54-68 (Jan.) 1943; Retrolental Fibroblastic Overgrowth of Persistent Tunica Vasculosa Lentis, ibid. **33**:203-208 (March) 1945.

17. Reese, A. B., and Payne, F.: Persistence and Hyperplasia of Primary Vitreous (Tunica Vasculosa Lentis or Retrolental Fiberplasia), Am. J. Ophth. **29**:1-24, 1946.

During 1946 and 1947 the premature babies born in the Strong Memorial Hospital were studied, with the collaboration of the pediatric service. There were 314 premature infants—44 were stillborn and 47 died within the first forty-eight hours after birth, leaving a total of 223 for study. All these babies weighed less than 2,500 Gm. This diagnosis of retrolental fibroplasia was made for 12 babies, 2 of whom were from other hospitals, an incidence of 4.43 per cent in premature babies of less than 2,500 Gm. When the babies who weighed less than 1,500 Gm. were included, there were 77 with the condition. Of these, 34 were stillborn, and 20 died during the first forty-eight hours of life and the eyes were not examined. Of the 23 babies in the study who weighed less than 1,500 Gm., 7, or 30.4 per cent, had the defect. Thus, the more premature the infant, the more likely is retrolental fibroplasia to be present.

Before the discussion of the cases, I shall review the embryology of this portion of the eye, as reported by Reese and Payne.[17] Ida Mann[14] and Haden.[18]

EMBRYOLOGY

First Period (up to 13 mm. stage).—At the 4.5 mm. stage, mesoderm begins to appear in the space between the lens plate and the optic vesicle. The mesoderm is part of the vasoformative cells which will grow in through the fetal fissure to form the hyaloid arterial system.

At the 10 mm. stage, large quantities of vascular mesoderm have grown in between the lens vesicle and the inner layer of the optic vesicle, forming the hyaloid artery, which is entering the eye through the fetal fissure.

At the 12 mm. stage the vitreous is a mass of fibrils derived from the lens and retina (ectoderm) and joining secondarily with fibrils (mesodermal) from the cells of the wall of the hyaloid artery.

At the 13 mm. stage the hyaline capsule surrounding the lens has been completely formed. The lens, therefore, no longer contributes to the formation of vitreous. Vitreous fibrils, remaining adherent to the lens capsule, condense to form a thin, fibrous envelope surrounding the lens and containing in its meshes the vessels of the vascular capsule. This fibrous capsule is the capsula perilenticularis fibrosa and originates from the lental part of the primary vitreous.

Development of Vessels in First Period: At the 6 to 7 mm. stage the terminal part of the hyaloid artery ends near the posterior surface of the lens plate; it sends capillary branches into the meshes of the capsula perilenticularis fibrosa, forming a vascular net over the posterior surface of the lens. This is the beginning of the tunica vasculosa lentis

18. Haden, H. C.: Concerning Certain Phases of the Development of the Vitreous, Tr. Am. Ophth. Soc. **39**:41-48, 1941.

and is seen in the 8 to 9 mm. stage. At the 10 mm. stage these vessels have extended anteriorly to form the lateral, or capsulopupillary, portion of the tunica vasculosa lentis.

The vitreous as it now exists is known as the primary vitreous. It consists of ectoderm derived from the lens and retina, as well as mesodermal vasoformative tissue, which has formed the hyaloid artery and the posterior and lateral portions of the tunica vasculosa lentis. The formation of the hyaloid capsule at the 13 mm. stage marks the end of the period of development of the primary vitreous.

Second Period (12 to 65 mm. stage).—At the 16 mm. stage arterial branches arising from the hyaloid artery have begun to project into the freshly forming vitreous and are termed the vasa hyaloidea propria.

At the 25 mm. stage the anterior, or pupillary, portion of the tunica vasculosa lentis has formed.

Up to the 40 mm. stage the vitreous is still full of vessels as far as the periphery, that is, to the internal limiting membrane. After this, the smaller vessels begin to atrophy, the portion nearest to the lens remaining visible the longest, with the result that the region nearest the retina becomes free of vessels. This avascular portion is known as secondary vitreous. Its appearance is due to atrophy of the blood vessels and further formation of additional vitreous from the retina as the eye enlarges.

There occur a cessation of growth of the primary vitreous and a continued increase in the amount of secondary vitreous, which fills the eye as it enlarges, thus giving a relative decrease in size of primary vitreous.

During the eighth month, the main trunk of the hyaloid artery becomes impervious in its central part, and atrophy proceeds more rapidly in its proximal portion, so that it loses connection with the disk and floats free in Cloquet's canal from the posterior surface of the lens, atrophying during the first few years of life.

REPORT OF CASES

CASE 1.—S. M. was first seen when she was 3 months old. Her mother had observed that the baby did not follow moving objects as had her five siblings at the age of 2 weeks. S. M. weighed 1,550 Gm. at birth. There had been no illnesses or complications during pregnancy. The baby's blood was Rh negative, type O M, while her mother's blood was Rh positive, type O M. The father's blood was Rh negative, type O M. All had negative Wassermann reactions. The diagnosis was made on March 14, 1946, with the characteristic findings, and roentgen therapy was ordered for the right eye, the left eye acting as a control. A dose of 200 r was given at monthly intervals, with 85 kilovolts, nine seconds' exposure and a 1 mm. aluminum filter. In September 1946, six months after the beginning of therapy, the right eye showed some clearing of the membrane tem-

porally. In April 1947, treatment with 100 r to the right eye was given at monthly intervals. In September 1947, the membrane was observed to be definitely thinner in the right eye. The lens was clear. No blood vessels could be seen. Vision was still limited to light perception only.

CASE 2.—B. Y. was the sixth baby; her brother and sisters had normal eyes. Her weight at birth was 1,300 Gm. The mother had had no complications or illness during pregnancy. The diagnosis was made by a pediatrician in September 1946, when the baby was 3 months old. Ophthalmologic examination, with the infant under anesthesia, showed in each eye a shallow anterior chamber, anterior pupillary membrane, irregular pupil and a definite vascular membrane on the posterior surface of the lens. Tonometric readings (Schiøtz) showed 18 mm. in the right eye and 20 mm. in the left eye. Roentgen radiation, 100 r, was delivered to each eye on April 21, June 16 and July 14, 1947 (factors: 85 kilovolts, 10 milliamperes, nine and one-half seconds' exposure, 10 cm. distance, 4 mm. portal, 1 mm. aluminum filter). The baby's blood was found to be Rh negative, type O M; the mother's, Rh positive, type O M, and the father's, Rh negative, type O M N. In September 1947, the retrolental membrane still exhibited vascularity, and the lens showed no cloudiness.

CASE 3.—M. R.'s mother had had two normal children before the patient's birth. However, she had had a spontaneous abortion before and one after the birth of this baby. The child was seen when she was about 2 years of age. Her ocular condition had been diagnosed as cataract. Her weight at birth was 1,150 Gm. On Oct. 7, 1946, examination, with the child under anesthesia, showed very shallow anterior chambers; the pupils dilated to 5.5 mm. with 1 per cent atropine sulfate; tension (Schiøtz) was 50 mm. in each eye. A thick vascular membrane was observed posterior to the lens of each eye. Roentgen irradiation was started in October 1946, and 100 r was given to each eye at monthly intervals for three months. The patient's blood was Rh positive, type O M N; the mother's, Rh negative, A M type, and the father's, Rh positive O M N type. Examination in September 1947 revealed no improvement.

CASE 4.—K. M., a first baby, weighed 1,300 Gm. at birth. The mother had observed that the infant had poor vision when he was 3 months of age. Examination in April 1947, with the child under anesthesia, showed a bilateral shallow anterior chamber, anterior pupillary membrane and dense vascular retrolental membrane, and the intraocular pressure was 26 mm. (Schiøtz) in each eye. The patient's blood was Rh positive, type B M N; the mother's, Rh negative, type A_2B M N, and the father's, Rh positive, type A. Beginning in May 1947, roentgen radiation was given at monthly intervals, 100 r being delivered to each eye. In September 1947 examination showed no improvement.

CASE 5.—R. B. was one of twins, whose weight at birth was 1,575 Gm. The mother had had a threatened abortion during the second month of pregnancy, after an automobile accident. Examination, with the baby under anesthesia, showed a very shallow anterior chamber bilaterally; the retrolental membrane was denser temporally and clearer nasally in each eye. The hyaloid artery and vein could be observed between the membrane and the optic disk. The intraocular pressure was 30 mm. in the right eye and 35 mm. in the left eye (Schiøtz). The patient's blood was Rh positive, type A_1M N; the mother's, Rh positive, type O M N, and the father's, Rh positive, type A_1M N. The diagnosis was made when the child was 18 months of age, and no therapy was given.

CASE 6.—K. M., a first baby, weighed 1,550 Gm. at birth. The diagnosis was made at 6 months of age. On Feb. 1, 1947, examination, with the patient under anesthesia, showed a shallow anterior chamber and posterior synechias, an intraocular pressure of 20 mm. (Schiøtz) and a dense, vascular retrolental membrane in each eye. The patient's blood was Rh positive, type O, while the mother's was Rh positive, type A, and the father's, Rh positive, type O. No treatment was given.

CASE 7.—J. E., a first baby, weighed 1,000 Gm. at birth. The condition was diagnosed when the infant was 3 months of age. Examination, with the child under anesthesia, showed intraocular pressure of 40 mm. (Schiøtz) in each eye, shallow anterior chambers and a small retrolental membrane temporally, with a falciform fold of retina in each eye. There was a coloboma of the optic nerve in the left eye. The patient's blood was Rh positive, type B M N.

Data on 6 Infants with Retrolental Fibroplasia

Case	Blood Type	Rh Factor	Wassermann Reaction	Total Dose of Roentgen Radiation
1 Patient S. M.	OM	—	—	1,400 r
Mother	OM	+	—	
Father	OM	—	—	
2 Patient B. Y.	OM	—	—	300 r
Mother	OM	+	—	
Father	OMN	—	—	
3 Patient M. R.	OMN	+	—	300 r
Mother	AM	—	—	
Father	OMN	+	—	
4 Patient K. M.	BMN	+	—	500 r
Mother	A_2BMN	—	—	
Father	A	+	—	
5 Patient R. B.	A_1MN	+	—	None
Mother	OMN	+	—	
Father	A_1MN	+	—	
6 Patient K. M.	O	+	—	None
Mother	A	+	—	
Father	O	+	—	

CASE 8.—D. A., a third child, weighed 1,310 Gm. at birth. The other children had normal eyes. The mother was epileptic and had had influenza two weeks prior to delivery. The infant's condition was diagnosed at the age of 6 months. Examination, with the patient under ether anesthesia, showed small eyes, with shallow anterior chamber, persistent anterior pupillary membrane and dense, vascular retrolental membrane; the intraocular pressure was 40 mm. (Schiøtz) in each eye. One drop of 1 per cent pilocarpine nitrate was given twice a day. Roentgen radiation, in a dose of 100 r at monthly intervals, was given for four months. Six months after treatment was started there was some nasal clearing of the membranes. Vision remained limited to light perception only. Studies of the blood were not completed.

CASE 9.—F. R., a first baby, weighed 1,620 Gm. at birth. The child's condition was diagnosed at the age of 5 months. There was no toxemia or complications of pregnancy. Examination, with the patient under anesthesia, revealed a typical picture. The intraocular pressure was 12 mm. (Schiøtz) in each eye. Blood studies were not completed.

CASE 10.—P. M. was one of double ovum twins; the weight at birth was 1,400 Gm. The child was the product of the mother's fifth pregnancy. The other children had normal eyes. Examination, with ether anesthesia, revealed a typical picture. The family moved to California, and blood studies were not made.

CASE 11.—B. M., a twin of the baby in case 10, weighed 1,200 Gm. at birth. The findings were similar to those in case 10.

CASE 12.—Studies in this case have not been completed.

Comment.—Of 9 eyes treated with roentgen radiation, 3 showed slight improvement, with slight thinning of the membrane at the less dense borders of the membrane, and 6 showed no apparent change. In no case was the thinning sufficient to be regarded as of any real help preliminary to needling of the lenses. Little or no effect on the membrane vessels could be observed.

DIFFERENTIAL DIAGNOSIS

The following conditions must be considered in differential diagnosis:

1. Retinoblastoma. This intraocular tumor is most commonly observed in children less than 6 years of age. It is usually unilateral at first, but may be found bilaterally. Ophthalmoscopic examination shows a yellowish mass, usually in the posterior half of the globe and definitely separated from the lens. On transillumination the tumor appears dark, indicating that light does not pass through it readily. The eye is normal in size or slightly enlarged. If the baby is seen after the tumor has progressed, the eye appears enlarged and congested with purulent material in the anterior chamber, which may lead to the mistaken diagnosis of panophthalmitis. One should always suspect the presence of retinoblastoma unless a definite history of penetrating injury is given.

2. Serous detachment of the retina. The eye is usually smaller than normal or of normal size. Ophthalmoscopic examination shows a grayish mass, slightly tinged with yellow, situated away from the lens. The readiness with which it may be transilluminated shows that only fluid is behind the retina.

3. Congenital cataract. The lens is opaque in varying degrees, and the anterior chamber is normal.

4. Retrolental fibroplasia. The lens is clear, but a dense membrane is observed just behind the lens. Blood vessels are always seen on this membrane if observed carefully. The anterior chamber is shallow, and the iris appears close to the cornea. The pupil may or may not be irregular in outline, according to whether or not adhesions have formed. Small strands and remnants of pupillary membrane, like a spider web, can be observed passing across the pupil.

SUMMARY

The treatment of retrolental fibroplasia with roentgen radiation produced little change in the vascularity of the membrane. A study of the possibility that a blood factor is a cause of prematurity in this congenital malformation led to no definite conclusion. Further studies of this type at several medical centers, with possibly a central registry, might bring useful information to light.

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DIFFERENTIAL DIAGNOSIS OF BOECK'S SARCOIDOSIS

Report of Ten Cases with Ocular Involvement

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AT PRESENT, the diagnosis of Boeck's sarcoidosis should be regarded as presumptive, for it is based on incomplete knowledge. There are no sure criteria for absolute diagnosis, whether from histologic sections of any tissue of the body, from laboratory tests, from roentgenograms or from complete postmortem examination. Therefore, all clinical evidence for Boeck's sarcoidosis must be most carefully evaluated before a diagnosis of the disease can be justified. The purpose of this article is to discuss the difficulties in establishing a clinical diagnosis of Boeck's sarcoidosis, to evaluate the more frequent clinical symptoms and signs and to present 10 cases of sarcoidosis and an analysis of the ocular part of the disease.

Considerable confusion exists in the differentiation of sarcoidosis from tuberculosis, silicosis, Hodgkin's disease and similar diseases. In the literature, the diagnosis of sarcoidosis is made in some cases on only scanty evidence. Rossell,[1] for example, made the diagnosis of sarcoidosis of the lung in 2 cases by comparing the roentgenograms of the chest with textbook pictures. King[2] reported 112 cases in which, in his opinion, the diagnosis of sarcoidosis was established. In 24 of these cases, he based his diagnosis on a biopsy of the skin or of a node, and in 15 cases, on the roentgenograms of the chest. These instances are mentioned not to criticize the authors, but to show the ease with which a presumptive diagnosis of sarcoidosis may be made on an insufficient basis. It has been noted that once the intriguing word "sarcoidosis" is suggested in the clinic record there is a tendency for other clinicians to accept that diagnosis without sufficient study.

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1. Rossell, G.: Deux cas de maladie de Boeck, Rev. méd. de la Suisse Rom. **59**:420-434, 1939; cited by Ronchese.[3c]

2. King, D. S.: Sarcoid Disease as Revealed in the Chest Roentgenogram, Am. J. Roentgenol. **45**:505-512, 1941.

It has been stated that Boeck's sarcoidosis may affect every tissue or organ in the body.[3] The disease is usually described, however, as limited to certain groups of organs, such as the eye, lung, lymph nodes, skin, bones, parotid gland,[4] brain, thyroid, testes, nose, pharynx, sinuses, kidney, spleen, bone marrow, liver, heart and intestinal tract. In general, sarcoidosis is a relatively benign, chronic disease, occasionally punctuated by acute exacerbations. The constitutional symptoms are usually slight, and fever, while it may sometimes be present in the early stage, more frequently is entirely absent. Most writers agree that the clinical symptoms produced by sarcoidosis are usually the result of mechanical obstruction, with the consequent irritation and interference with function, rather than those of a general toxemia or systemic reaction; for example, many patients may die of failure of the right side of the heart.

RELATION OF SARCOIDOSIS TO TUBERCULOSIS

Boeck's sarcoidosis cannot be reasonably discussed without inclusion of some of the evidence concerned with its possible relation to tuberculosis. No concrete proof of such a relation has, as yet, been generally accepted, and the subject is controversial.

It has been claimed that tubercle bacilli have been found in some instances in stained sections of skin showing the early inflammatory lesions, but they disappear as the sarcoid nodules develop. Proponents of this theory of tuberculous origin are many, and they further propose that this early destruction of the tubercle bacilli may account for the negative reaction to the intracutaneous injection of tuberculin. Whether the early disappearance of the organism is due to its low virulence or to some special reaction of the patient is not known.

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3. (*a*) Harrell, G.: Generalized Sarcoidosis of Boeck, Arch. Int. Med. **65**: 1003-1034 (May) 1940. (*b*) Nickerson, D. A.: Boeck's Sarcoid: Report of Six Cases in Which Autopsies Were Made, Arch. Path. **24**:19-29 (July) 1937. (*c*) Ronchese, F.: Sarcoid and Tuberculosis: Report of a Case with Autopsy, Arch. Dermat. & Syph. **46**:860-871 (Dec.) 1942. (*d*) Reisner, D.: Boeck's Sarcoid and Systemic Sarcoidosis, Am. Rev. Tuberc. **49**:437-462, 1944. (*e*) Schaumann, J.: Lymphogranulomatosis Benigna in the Light of Prolonged Clinical Observations and Autopsy Findings, Brit. J. Dermat. **48**:399-446, 1936.

4. (*a*) Guyton, J. S., and Woods, A. C.: Etiology of Uveitis: A Clinical Study of 562 Cases, Arch. Ophth. **26**:983-1018 (Dec.) 1941. (*b*) King, M. J.: Ocular Lesions of Boeck's Sarcoid, Tr. Am. Ophth. Soc. **37**:422-458, 1939. (*c*) Schultz, A.: Boeck's Sarcoid with Uveoparotitis and Dacryoadenitis, Am. J. Ophth. **28**:1010-1014, 1945. (*d*) Woods, A. C., and Guyton, J. S.: Role of Sarcoidosis and of Brucellosis in Uveitis, Arch. Ophth. **31**:469-480 (June) 1944. (*e*) Walsh, F. B.: Ocular Importance of Sarcoid: Its Relation to Uveoparotid Fever, ibid. **21**:421-438 (March) 1939.

Schaumann [5] proposed that it was a difference in the type of tubercle bacillus which accounted for the difference between sarcoidosis and tuberculosis. Schaumann and Hallberg [6] claimed a demonstration of Mycobacterium tuberculosis by special staining methods and stated the belief that the peculiar structures, called Schaumann bodies, in the giant cells were, in fact, this organism. Harrell [3a] and Longcope [7] failed to find evidence of tuberculosis but expressed the belief that alterations in the chemical constituents of the blood, particularly an increase in the globulin factor, may be an aid to diagnosis.

Pinner, Weiss and Cohen [8] proposed that a tuberculin-neutralizing substance, anticutin, may be a factor differentiating the reactions of sarcoidosis from those of tuberculosis in the body. In subjects showing the presence of anticutin, tuberculosis may take the form of sarcoidosis. They stated that anticutins were present in 36 per cent of patients with sarcoidosis but in only 5 per cent of normal subjects and tuberculous patients.

Beinhauer and Mellon [9] recovered a pure culture of diphtheroid bacilli with acid-fast granules from the lymph nodes of 5 patients with sarcoidosis. These patients had negative cutaneous reactions to tuberculin, but reacted positively to a culture of diphtheroids; Schwartzchild [10] failed to confirm these findings. Other evidences of the relation of sarcoidosis to tuberculosis are the frequent history of tuberculous contacts in patients with sarcoidosis, the common occurrence of sarcoidosis in known tuberculous areas of the population, such as the countries of Scandinavia, and the frequency of sarcoidosis in Negro settlements, where tuberculosis is known to be prevalent. There are also not a few cases reported in the literature in which patients with a well established

5. Schaumann, J.: On the Nature of Certain Peculiar Corpuscles Present in the Tissue of Lymphogranulomatosis Benigna, Acta med. Scandinav. **106**:239-253, 1941.

6. Schaumann, J., and Hallberg, V.: Koch's Bacilli Manifested in the Tissue of Lymphogranulomatosis Benigna (Schaumann) by Using Hallberg's Staining Method, Acta med. Scandinav. **107**:499-501, 1941.

7. (*a*) Longcope, W. T.: Sarcoidosis, or Besnier-Boeck-Schaumann Disease, J. A. M. A. **117**:1321-1327 (Oct. 18) 1941. (*b*) Longcope, W. T., and Pierson, J. W.: Boeck's Sarcoid (Sarcoidosis), Bull. Johns Hopkins Hosp. **60**:223-296, 1937.

8. Pinner, M.; Weiss, M., and Cohen, A. C.: Procutins and Anticutins, Yale J. Biol. & Med. **15**:459-463, 1943.

9. Beinhauer, L. G., and Mellon, R. R.: Pathogenesis of Noncaseating Epithelioid Tuberculosis of Hypoderm and Lymph Glands, Arch. Dermat. & Syph. **37**:451-460 (March) 1938.

10. Schwartzchild, L.: Comparison of Old Tuberculin (Koch) and Modified Tuberculin (Mellon and Beinhauer), Arch. Dermat. & Syph. **42**:461-465 (Sept.) 1940.

diagnosis of sarcoidosis have died of proved terminal tuberculosis (case 4). The problem of the relation of sarcoidosis and tuberculosis cannot be dropped at this point, for it reappears frequently and provokingly throughout the various phases of the discussion and report of cases which follow.

DIAGNOSTIC PROCEDURES AND PROBLEMS

Physicians who are confronted with the problem of diagnosis of sarcoidosis usually depend on one or more of the following procedures to furnish clinical information: examination of the eyes; biopsies of the skin, lymph nodes and nasal mucosa, and roentgenographic studies of the chest and bones of the hands and feet. In clinical practice, then, the patient may be seen by several specialists, including the ophthalmologist, the otolaryngologist, the dermatologist, the chest clinician and the roentgenologist, with the general pathologist often giving an additional opinion on biopsied material. The procedure and some of the problems of diagnosis pertaining to each specialty will be discussed before an attempt is made to analyze the 10 cases reported.

Ocular Disease.—The patient with sarcoidosis is seldom acutely ill; the cutaneous lesions are not painful and seldom disfiguring, and the thoracic condition is usually unsuspected. The eyes, however, may be painful; vision may be blurred, or at least the ocular disease may be severe enough to cause the patient to seek medical advice.

Briefly, an examination of the eye may reveal any combination of nodules of the lids, conjunctivitis, keratitis, iritis, iridocyclitis and, rarely, chorioretinitis, with any of the possible symptoms and complications of these conditions. The severest and most obvious feature is generally iritis [11] of the nodular or seroplastic type, with extensive posterior synechias, and there is an abundance of the keratic precipitates of the mutton fat type. In this series of cases, keratitis was a common condition. The eye may be painful in the acute stage, or it may be painless with the insidious onset of the disease. Chronicity following either the stormy or the insidious beginning is the almost invariable course.

Only a description of the disease and a diagnosis of nodular iritis related to a granulomatous disease, or of seroplastic iritis of unknown cause, may be given, for the initial ocular inspection reveals little of aid in differential diagnosis. Most ophthalmologists agree that there may be only a suggestion that the causative factor lies in a granulomatous disease. In the presence of the more obvious lesions of the skin, and possibly of some enlarged lymph nodes, sarcoidosis should be suspected and considered. Intradermal tests with old tuberculin and brucella

11. Guyton and Woods.[4a] Levitt, J. M.: Boeck's Sarcoid with Ocular Localization: Survey of the Literature and Report of a Case, Arch. Ophth. **26**:358-388 (Sept. 4) 1941.

antigen; blood counts; determination of the sedimentation rate; urinalysis; serum agglutination tests for typhoid, paratyphoid, tularemia, brucellosis and the rickettsial diseases; the Kahn tests, and stereoscopic roentgenographic examinations of the chest should also be made on patients with sarcoidosis in a search for other diseases.

Thoracic Disease.—Lesions in the chest are not necessarily characteristic, but they are probably the most frequent clinical sign and their proper interpretation is of great aid in the clinical diagnosis of sarcoidosis. The roentgenologist, however, must use the history and available clinical data for intelligent interpretation of the roentgenograms.

Two general types of thoracic lesions are associated with sarcoidosis. The first type is that of involvement of the hilar nodule, consisting of gross enlargement of the bronchial nodes, or less often, of the bifurcation of the paratracheal groups, with coarse radiations of dilated, deep lymphatic striae extending from the enlarged nodes toward the periphery of the lungs. These deep lymphatic vessels, unlike pulmonary vessels, seldom bifurcate and are denser, narrower and more sharply defined than are blood vessels. This peripheral prolongation of the striae is sometimes called fibrotic extension. The term is proper only in relation to the configuration of the density, and does not necessarily mean fibrosis of the lung in the sense of proliferated fibrous tissue. The fact that these pulmonary lesions often completely resolve is not in keeping with the impression of permanence of fibrous tissue. It is the opinion of roentgenologists in this clinic that one of the important features of extension from the hilar nodes in sarcoidosis, in contrast to tuberculous extension, is that it is quite uniformly bilateral, and that both pulmonary fields may be conspicuously involved in their central and lower parts, with sparing of the apexes. In tuberculosis it is rare to find widespread parenchymatous extension without invasion of the apexes.

In the second type of thoracic lesions the involvement of the hilar nodules is accompanied with or followed by widespread miliary lesions of irregular size throughout both lungs. If the hilar nodes are small, the picture may be similar to that of miliary tuberculosis, and may at times be impossible to differentiate by roentgenograms alone. The roentgenologist must correctly evaluate the degree of illness of the patient, the temperature curve, the sedimentation rate and other available clinical information. With this method, sarcoidosis or miliary tuberculosis may be considered probable or very unlikely.

The two types may be present at the same time. In some cases in which there are small hilar nodes and widespread miliary lesions with deep and superficial striations, the picture may be identical with miners' silicosis. It has been pointed out that gross enlargement of

the bronchial glands is rare with miliary tuberculosis, except in the Negro, and that it is unknown in miners' silicosis. Possible exposure to high concentrations of silica dust should, of course, be considered in the history.

Roentgenographic differential diagnosis of sarcoidosis and late Hodgkin's disease or lymphoblastoma may also be impossible. Here, again, other clinical factors, such as a blood dyscrasia, histologic changes in a lymph node or enlargement of the spleen, may help to identify the disease. If other clinical signs of Hodgkin's disease or lymphoblastoma are lacking, a trial of high voltage roentgen irradiation of the hilar nodes may safely be attempted, for it is well known that these diseases are sensitive to radiation and, if they are present, the resolution of the pulmonary lesions is often dramatic. Pohle, Paul and Clark[12] reported 14 cases in which high voltage irradiation to the hilar region of patients with sarcoidosis was attended with no untoward results. In fact, it is the authors' impression that in 6 of the cases slight improvement occurred, but nothing similar to the results obtained with Hodgkin's disease.

The roentgenographic picture of sarcoidosis may further be confused by the presence of calcified nodes, pleural thickening, effusions or even cavitations. Without previous roentgenograms, it is not possible to determine whether the sarcoidosis is superimposed on old tuberculous lesions or is the present active disease. It is not believed that calcifications, effusions or cavitations are part of the pulmonary picture of sarcoidosis, but their presence before lesions of sarcoidosis occur make the picture more like tuberculosis than sarcoidosis. These complications are mentioned to show the difficulties that may be encountered in diagnosis of sarcoidosis of the chest. It is not surprising that the roentgenologist may frequently report tuberculosis of the chest rather than sarcoidosis. The experience in this clinic is that either tuberculosis or Hodgkin's disease is often the first roentgenographic diagnosis, rather than sarcoidosis. If the lesions of the chest were uniformly typical of one or the other of the two types mentioned, the roentgenologist's problem would be greatly simplified.

Lesions of Bone.—Roentgenographic evidence of lesions of bone is considered to be valuable as a diagnostic clue to sarcoidosis. Unfortunately, these lesions are not common. Woods and Guyton[4d] stated that lesions of bone occur in about 10 per cent of reported cases; however, none were observed in their 15 cases. The typical lesions are observed in the metaphyses of the phalanges and in the metacarpal bones of the hands and feet. They are definite, punched-

12. Pohle, E. A.; Paul, L. W., and Clark, E. A.: Roentgen Therapy of Boeck's Sarcoid, Am. J. M. Sc. **209**:503-513, 1945.

out lesions with rather sharp borders, and they appear to be located in the exact center of the metaphysis of the bone and do not invade the cortex. Before the advent of popularity of the diagnosis of sarcoidosis these punched-out lesions of bone were called tuberculosis osteitis cystica (cases 4 and 10).

Disease of the Nasal Mucosa.—The rhinologists in this clinic have found that histologic evidence of sarcoid or tuberculosis is extremely rare in the mucous membrane of the nose and accessory sinuses. In a series of biopsies in presumptive cases of sarcoidosis, histologic sections that particularly resemble sarcoid granulomas were not observed. The usual report was chronic inflammatory tissue, with hypertrophy of the mucosa, which was richly supplied with mucin glands. There were sometimes groups of epithelioid cells, but any grouping of these cells into well organized tubercles resembling either tuberculosis or sarcoid was rare; in fact, small tubercle-like whorls were noted in only 1 case of the series. Several factors may account for this picture: The nasal mucosa may be resistant to invasion by or reaction to the tubercle bacillus. The tissue structure may be such that it does not lend itself to formation of tubercles or sarcoid granulomas. Other bacterial reactions, in the form of secondary invaders, may distort and inhibit granulomatous formation.

Cutaneous Lesions.—The gross description of the cutaneous lesions falls into three types, with additional variations for the Negro[13]:

1. Disseminated miliary sarcoidosis (Boeck) is an eruption of firm nodules which may be found on any surface of the body. Occurring in small numbers, usually on the face, arms, shoulders or hands, these nodules vary in size and shape and are brownish red or purplish. Under pressure, they appear as grayish yellow macules in the skin. If they heal, atrophic scars are formed.

2. In subcutaneous sarcoidosis (Darier-Roussy sarcoid[14]), the nodules are subcutaneous, and the skin may be freely movable over them. They are round and several centimeters in diameter and feel like soft shot under the skin. They may be located anywhere on the body, singly or in groups, sometimes forming plaques. The color is that of the skin, there being occasionally a bluish discoloration of the skin over the nodules.

3. In lupus pernio, superficial lesions affect the nose, cheeks, ears, hands and feet. These lesions appear as infiltrating, bluish

13. (*a*) Bloom, D., and Mendelsohn, H.: Cutaneous Tuberculosis in the Negro: A Clinical Entity, Arch. Dermat. & Syph. **36**:937-951 (Nov.) 1937. (*b*) Nomland, R.: Hematogenous Cutaneous Tuberculosis (Sarcoid) in Negroes, ibid. **30**:59-75 (July) 1934.

14. Maloney, E. R., and Combes, F. C.: Darier-Roussy's Sarcoid, Arch. Dermat. & Syph. **33**:709-724 (April) 1936.

or violaceous plaques. The surface shows a well marked network of dilated blood vessels. In the Negro, any of these three types of lesions may be found, in addition to superficial scaling plaques and superficial nodules about the mouth, nose, eyelids and brow.

Biopsy of the skin, with microscopic examination of the stained sections, is also an aid in diagnosis of sarcoidosis.[15] The structure of the skin seems to lend itself to more uniformity in the microscopic appearance of sarcoid lesions than any other tissue of the body. For that reason, perhaps, dermopathologists feel more certain of their diagnosis of sarcoidosis than do pathologists dealing with other tissue. The more typical lesions of sarcoidosis are described as very compact, small whorls of distinct epithelioid cells, without evidence of central necrosis and with few giant cells and a very sparse surrounding mantle of lymphocytes, or more typically the lymphocytes may be absent. The conglomerate whorls are spaced and surrounded by heavy and distinct connective tissue trabeculae of collagenous fibers, which are indicative of the disease. No organisms are found. Woods and Guyton [4d] stated that in 20 per cent of cases peculiar, hematoxylin-staining, usually doubly refractile inclusions, known as Schaumann bodies, are seen in the giant cells; but if Schaumann bodies are not present, it is impossible to differentiate lesions of sarcoidosis histologically from the hard tubercles of tuberculosis. The picture in histologic sections of the skin is, unfortunately, not an infallible test, for not all sections are typical.

The case described by Ronchese [3c] is an excellent illustration of the diverse opinion of dermopathologists in the microscopic differential diagnosis of Boeck's sarcoidosis and lupus vulgaris (tuberculosis). A histologic section, a clinical photograph and a brief summary of the history in this case were sent to 10 eminent dermopathologists; 6 favored the diagnosis of sarcoidosis, and 2 the diagnosis of lupus vulgaris; 2 stated that the picture was consistent with either sarcoidosis or lupus vulgaris. The opinions of the roentgenologists in regard to the roentgenograms of the chest were likewise almost equally divided between sarcoidosis and miliary tuberculosis. The autopsy in this case, held within seven months of examination of the microscopic sections and the roentgenograms of the chest, was reported by Dr. F. E. Katzman and Dr. R. J. Williams to reveal the presence of typical acid-fast bacilli in the lesions of the lung, spleen and heart, confirming the diagnosis of miliary tuberculosis.

15. Longcope.[7a] Longcope and Pierson.[7b] Nomland.[13b] Jordon, J. W., and Osborne, E. D.: Besnier-Boeck's Disease, Arch. Dermat. & Syph. **35**:663-684 (April) 1937. Laymon, C. W., and Michelson, H. E.: The Micropapular Tuberculid, ibid. **42**:625-640 (Oct.) 1940. Montgomery, H.: Histopathology of Various Types of Cutaneous Tuberculosis, ibid. **35**:698-715 (April) 1937.

Biopsy of Lymph Nodes.—The microscopic structure of sarcoidosis of the lymph nodes is not so uniform as that of the cutaneous lesion. The tissue of the lymph node is apt to have a confusing number of lymphocytes and giant cells; collagenous trabeculae are usually absent. The picture is not easily confused with tuberculosis, but differential diagnosis is often impossible. A feature of sarcoid of lymph nodes, pointed out by Dr. Eleanor Humphreys, of the University of Chicago, is that the epithelioid whorls often surround a small central vessel. This picture is never seen with tuberculosis, since central necrosis is frequent in tuberculous lymph nodes and could hardly occur with a functioning central vessel. Great variations in individual lymph nodes from the same patient also exist, and excellent examples of sarcoid adenitis and tuberculous adenitis in a patient with proved tuberculosis have been observed.

Mantoux Test.—A negative result in the Mantoux test is of value in the diagnosis of sarcoidosis; however, evaluation of the significance of the reactions is somewhat in doubt. In this clinic, every patient suspected of having sarcoidosis is given an intradermal injection of 0.1 cc. of a suspension of old tuberculin U. S. P. in saline solution [4d] in a dilution of 1:100,000, the dilutions being increased through strengths 1:10,000, 1:1,000, 1:100 and 1:10 to an undiluted suspension. The reactions are evaluated at the end of twenty-four, forty-eight and seventy-two hours. Some of the patients with sarcoidosis show no reaction even to the undiluted old tuberculin, and Woods and Guyton carried out this test with 10 cc. of undiluted old tuberculin without reaction in some of their cases. In all but 1 of the cases reported in this paper the cutaneous reactions were negative to dilutions of 1:1,000, and most patients were insensitive to stronger concentrations. The meaning of this is not clear, but in this clinic the arbitrary acceptance of a positive cutaneous reaction to a 1:100 dilution is compatible with a diagnosis of sarcoidosis, whereas a positive reaction to a dilution of 1:1,000 is considered questionable.

REPORT OF CASES

CASE 1.—J. J., a Negro housewife aged 25, was first seen in the eye clinic in March 1946. The patient complained of decreased vision and a growth in the left eye; she had discovered the growth in December 1944 on looking into a mirror; a short time prior to discovery of the tumor the left eye had been painful, but since December 1944 it had been painless. The patient had otherwise been well.

During the nine months following the ocular symptoms she had tremor of the hands, fatigue and pronounced early muscular weakness. There was no cough or fever. The condition was diagnosed by a physician as a "nervous breakdown." A routine industrial roentgenogram of the chest in the spring of 1944 revealed nothing noteworthy. The patient had had an obstruction of the left nostril since

March 1944, with pain over the left maxillary sinus. She had had the usual childhood diseases; the family history was noncontributory except that the patient's mother was said to have died of tuberculosis at the age of 36.

A brief summary of results of the ophthalmologic examination follows. Vision was 20/16 in the right eye and 20/100 in the left. The right eye was not diseased. In the left eye a large, yellowish pink tumor was to be seen growing up from the iris and filling about one fourth of the anterior chamber. The tumor extended in a circular manner at the limbus from 6 to 9 o'clock. In this sector it filled the angle of the anterior chamber, and the anterior surface of the tumor in places pressed against, but was not attached to, the cornea. The surface of the tumor was slightly lobulated and was covered with a fine network of capillaries, arising from the iris but not from the deep portion of the limbus or the cornea. The pupil was bound down with ringlike posterior synechias, and the pupillary aperture was covered with a thin gray membrane. The aqueous showed a moderately increased flare and a few floating cells; the cornea was clear except for a large number of keratic precipitates on the endothelium of mutton fat type. The fundus appeared normal. Intraocular tension (Schiøtz) was normal in both eyes.

Three weeks after the first examination a rare opportunity was afforded us to observe the beginning of sarcoid iritis in the right eye. The first sign recognized on observation with the slit lamp was beginning exfoliation of the iris pigment at the pupillary border. A small increase in the aqueous flare next developed, and then three tiny nodules were seen beneath the anterior surface of the iris, two being located near the limbus and one near the pupillary border. During the next two weeks the nodules increased slowly in size; a few cells appeared in the aqueous; the flare increased, and, last, the keratic precipitates of mutton fat type appeared in considerable numbers. The final picture was one of nodular iritis with the Koeppe nodules, which were light gray, round and about 1 mm. in diameter and 0.5 mm. in height.

Roentgenograms of the chest showed infiltration of the hilar regions, with extension along the superior mediastinum and into both upper lobes, the distribution suggesting sarcoid disease. Roentgenograms of the bones of the hands and feet were normal.

Several small subcutaneous masses, 5 to 8 mm. in diameter, were found on the flexor surfaces of the arms and in the left cervical region. The skin was freely movable over the lesions, a condition resembling the Darier-Roussy sarcoid (fig. 1). Biopsy of a subcutaneous nodule revealed a mass of highly vascularized granulation tissue, in which epithelioid cells were occasionally arranged to form tuberculoid structures with a few Langhans giant cells. No caseation necrosis was seen. The total picture was compatible with sarcoidosis.

Routine laboratory tests gave normal results. The Kahn test and intradermal injections of old tuberculin in dilutions up to, and including, 0.1 cc. of undiluted suspension gave negative reactions. Biopsy of the nasal polyps revealed no evidence of sarcoid tissue. Roentgen therapy was tried for the tumor of the iris; after four treatments the mass appeared slightly shrunken, but again increased in size during the subsequent six treatments. The patient was last observed in August 1946. The tumor of the iris was of the same size. Vision was 20/16 in the right eye and was limited to perception of hand movements in the left eye.

In April 1947 the patient died at another hospital, after several weeks of severe weakness. The cause of death was given as tuberculous meningitis on the basis of neurologic findings of meningeal irritation, stupor leading to coma and one doubtful report of tubercle bacilli in the sputum.

Diagnostic Criteria.—The patient had nodular iritis and cutaneous lesions of the Darier-Roussy type. Microscopically, the cutaneous lesions were compatible with, but not typical of, sarcoidosis. Roentgenograms of the chest in the absence of other clinical signs of Hodgkin's disease and malignant growth were compatible with the hilar type of sarcoidosis, especially since the cutaneous tests gave negative reactions to 0.1 cc. of undiluted old tuberculin. The nodular iritis could not be differentiated from other granulomatous diseases, particularly tuberculosis. In this case, the roentgenograms of the chest and the general clinical picture were considered as of the most diagnostic value, with cutaneous lesions, biopsy observa-

Fig. 1 (case 1).—Flexor surface of forearm, showing subcutaneous nodules of the Darier-Roussy type of Boeck's sarcoidosis (March 1946).

tions on the skin, the negative reaction to tuberculin and the nodular iritis of importance, in approximately that order.

Case 2.—Mrs. M. B., a white woman aged 59, a rooming house keeper, was first seen in the eye clinic in February 1947. She complained of black spots before her eyes, ocular burning and itching, and a yellow, sticky secretion of three monhts' duration. There had been no periods of weakness, loss of weight, cough or fever. Moderately severe diabetes had been discovered one year before, when the patient became suspicious of polyuria. The diabetes was controlled with modified diet and administration of 15 units of protamine zinc insulin three times daily. Her family history was negative for tuberculosis, and she had had no contact with the disease.

Vision was 20/40 in the right eye and 20/25 in the left eye. The conjunctivas were moderately injected. The substance of the right cornea was clear. On the corneal endothelium were numerous round keratic precipitates of the mutton fat type. The aqueous showed a moderately increased flare and occasional floating cells. The iris was edematous, but without nodules. The right pupil dilated to 0.5 mm. with atropine, without evidence of synechias. The left eye was normal. Both fundi were clearly seen; no abnormality was noted other than moderate sclerotic changes of the retinal vessels. The intraocular tension (Schiøtz) was within normal limits in each eye. Routine laboratory tests gave normal results, and the reaction to the Kahn test was negative.

The first stereoroentgenograms of the chest were reported to show minimal hilar calcification and normal lung fields, with evidence of minimal healed

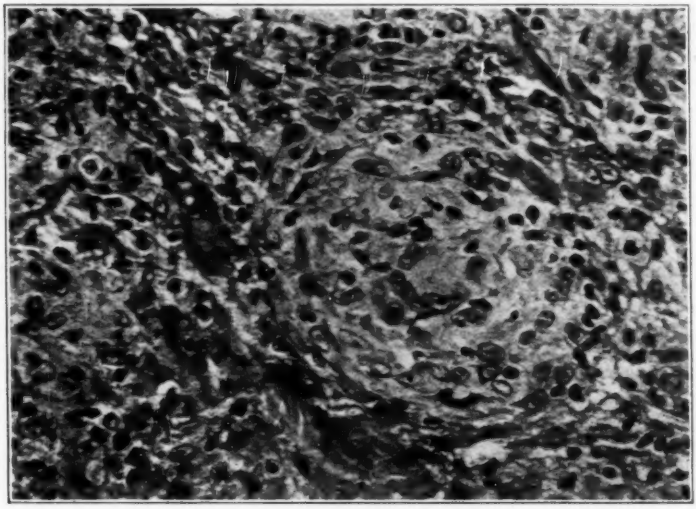


Fig. 2 (case 2).—Biopsy specimen of the skin, showing multiple whorls of epithelioid cells, with noncaseating centers and scant lymphocytes, highly suggestive of Boeck's sarcoidosis; × 460 (April 1947).

tuberculosis. The impression was that of iritis, tuberculous type. The reaction to intradermal injection of old tuberculin in a dilution of 1:1,000 was negative. Within a few weeks a bluish discoloration was noticed on the end of the patient's nose. The dermatologist diagnosed the lesion as sarcoidosis of the lupus pernio type and confirmed this diagnosis by biopsy of a specimen from the skin of the nose (fig. 2). In a review of the roentgenograms of the chest by another roentgenologist, one very large, soft hilar gland, measuring over 1 inch (2.5 cm.) in diameter, was seen. The lesion was reported as probably very early sarcoid. For nine months no appreciable change occurred in the patient's condition.

Diagnostic Criteria.—This patient had seroplastic iritis and cutaneous lesions of the lupus pernio type, with biopsied material strongly indicative of sarcoidosis.

Roentgenograms of the chest which suggested, but were not typical of, sarcoidosis and a negative cutaneous reaction to old tuberculin in a dilution of 1 : 1,000 were added factors influencing the diagnosis. The cutaneous sensitivity tests were not carried further because empiric tuberculin therapy was instituted before a diagnosis of sarcoidosis was made. In this case, the biopsy of the skin and the cutaneous lesions were considered the most important diagnostic features, with the negative reaction to old tuberculin, the roentgenograms of the chest and the iritis of importance approximately in that order.

Case 3.—Dr. R., a Negro housewife aged 36, was seen in the eye clinic in July 1946. She gave a history of redness and burning of the right eye, which began in September 1946. The condition of the eye improved for a few months, but seven months later it became worse, at which time the left eye also became red. In June 1946 roentgenograms of the chest and biopsy of a cervical lymph node were reported as showing typical signs of Boeck's sarcoidosis. The patient gave no history of serious or chronic illness before her ocular symptoms began. During the past fifteen months she had lost 20 pounds (9.1 Kg.) in weight but had no cough, fever or feeling of fatigue. Several brothers and sisters of the patient's mother were said to have died of tuberculosis, but they had had no direct contact with this patient. The family history was otherwise not significant.

The ophthalmologic examination showed vision of 20/70 in the right eye and 20/25 in the left eye. The conjunctiva of the right eye was moderately injected. The corneal epithelium and stroma were clear. There were a few round, mutton fat keratic precipitates on the corneal endothelium, a moderate increase in aqueous flare and 5 to 6 floating cells per smallest pinhole field of the slit lamp. No new vessels or nodules were seen in the iris. The pupil was held to a diameter of 2.5 mm. by numerous heavy posterior ring synechias. The anterior capsule of the lens showed well scattered deposits of brown pigment, and the pupil was covered with a thin gray veil continuous with the ring synechia. The left eye presented a picture similar to that of the right eye, with smooth conjunctival injection, clear cornea, mutton fat keratic precipitates, aqueous flare, cells and synechias, all in slightly lesser amounts. Both lenses were clear, and the fundi were normal. The interocular tension (Schiøtz) was normal in each eye.

Roentgenograms of the chest showed moderate enlargement of the mediastinal lymph nodes, the largest node measuring 4 cm. The pulmonary fields were otherwise clear. The clinical diagnosis was moderate hilar lymphadenopathy, compatible with sarcoidosis. Roentgenograms of the small bones of the hands and feet revealed no disease. An intradermal test gave a negative reaction to 0.1 cc. of undiluted old tuberculin. The ears, nose and throat were normal, and no cutaneous lesions were present. A few cervical lymph nodes were palpable. Routine laboratory tests gave normal results, and the Kahn reaction was negative. The eyes improved spontaneously, beginning in September 1946, but one year later both eyes again became worse. The patient became acutely ill, with severe weakness and further loss of weight, but without fever or cough. Vision in October 1947 was still 20/40 in each eye.

Diagnostic Criteria.—The patient had a seroplastic type of iritis. The lesions of the chest were indicative of sarcoid disease, in view of the negative cutaneous reaction to undiluted old tuberculin. The results of biopsy of a lymph node contributed to the impression of sarcoidosis. In this case, roentgenograms of the chest and the negative reaction to tuberculin were considered primary evidence in the diagnosis. Biopsy of a lymph node gave information of secondary importance because of the usual difficulty in differentiating sarcoidosis and tuberculosis in the lymph node. Iritis was considered of least value.

Case 4.—J. W., a Negro laborer aged 27, first seen in the eye clinic in January 1947, gave a history of illness beginning two years before with pain, tearing and gradual decrease in vision in the left eye. Nodules appeared in the skin of both upper eyelids. A short time later, nodules the size of a pea were found in the skin of the neck, arms and legs. The patient gave no history of chronic cough, fever, loss of weight or fatigue. His past and family histories were noncontributory.

On examination, many intracutaneous papules of the face and eyelids were seen. The upper lids were thickened. The right conjunctiva was smooth, hyperemic and free of follicles. The upper fifth of the cornea showed a sclerosing keratitis, the opacities extending through all layers, and was infiltrated with superficial pannus of the same extent as the sclerosis. Examination with the slit lamp demonstrated no changes in the aqueous, iris or lens.

There was severe photophobia of the left eye. There were three yellow follicles, 1 mm. in diameter, with red borders on the conjunctiva of the upper lid, but the remaining conjunctival surface was intensely hyperemic. A deep vascularized keratitis and a macular opacity covered most of the cornea. The aqueous appeared clear; the atrophic iris had an annular synechia, and the lens was densely cataractous. The right fundus appeared normal. Vision was 20/16 in the right eye and was limited to light perception in the left eye. The intraocular tension (Schiøtz) was normal in each eye.

Roentgenograms of the hands and feet showed an abnormal condition. Round areas of decreased density were seen in the metaphysial region of the distal end of the second phalanx of the third toe of the left foot (fig. 3 *A*); in the proximal metaphysial region of the middle phalanx of the fourth finger of the left hand (fig. 3 *B*), and in the distal phalanx of the same finger and that of the third digit. The impression was that of Boeck's sarcoidosis of the phalanges of both hands and feet. The roentgenograms of the chest revealed the presence of irregular, soft, fibrous infiltrations scattered throughout both lungs, with minimal bilateral thickening of the apical pleura and a suggestion of cavity formation in the lateral aspect of the upper lobe of the right lung near the fifth interspace (fig. 4 *A*). The impression was that of widespread pulmonary infiltration with questionable cavitation of the upper lobe of the right lung. From the roentgenologic standpoint, this evidence was compatible with tuberculosis, but, because of the lesions of the eyes, skin and bones, it was decided that the disease should be called sarcoidosis. The patient had a strong reaction to old tuberculin in a dilution of 1:1,000. The laboratory tests all gave results within normal limits, the Wassermann reactions of the blood and spinal fluid were negative, and the colloidal gold curve was normal. In August 1947, roentgenograms showed only an increase in pleural thickening and no change in osseous rarefactions in the hands and feet.

In the same month the patient entered the hospital acutely ill with severe pain in the chest and high, spiking fever. Physical examination and roentgenograms of the chest (fig. 4 *B*) showed a large pleural effusion, which was regarded as tuberculous. However, acid-fast organisms were not found on inoculation of guinea pigs with the aspirated fluid, nor were the bacilli found in repeated examinations of the sputum and stomach washings. The sensitivity of the skin to a 1:1,000 dilution of old tuberculin persisted. The chest clinicians, nevertheless, felt that the patient had terminal tuberculosis. On Sept. 19, 1947, tubercle bacilli were obtained by smear and culture of material from a caseous axillary lymph node.

Diagnostic Criteria.—This case was most interesting from a diagnostic viewpoint. Anterior uveitis, keratitis and cutaneous lesions clinically compatible with

Fig. 3 (case 4).—*A*, rarefaction of bone in toe, and, *B*, rarefaction of bone in finger, both highly suggestive of Boeck's sarcoidosis (January 1947).

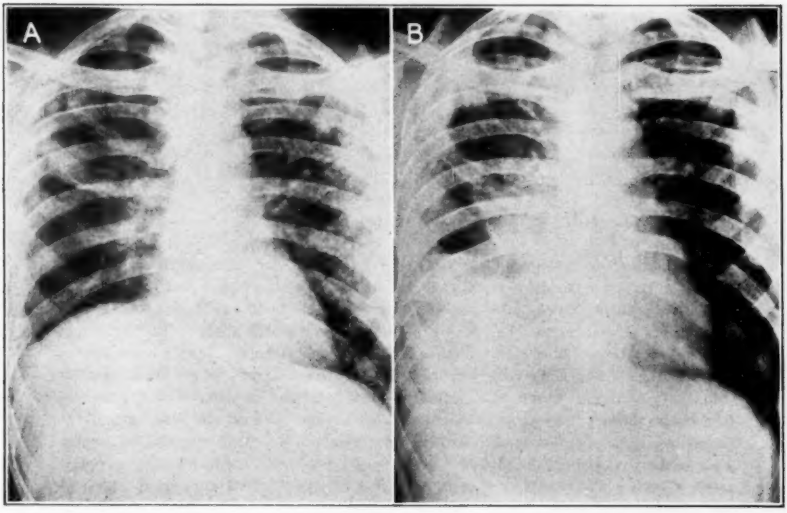


Fig. 4 (case 4).—*A*, roentgenogram of the chest (August 1947), suggestive of tuberculosis but compatible with Boeck's sarcoidosis; *B*, roentgenogram of the same chest as that shown in *A*, taken two weeks later, now showing right pleural effusion, suggestive of tuberculosis, and not of Boeck's sarcoidosis.

sarcoidosis were observed. The roentgenograms of the chest were equivocal, and the skin was sensitive to old tuberculin in a dilution of 1:1,000. The bones had the punched-out rarefactions supposedly typical of Boeck's sarcoidosis. Although the patient's disease was diagnosed as presumable sarcoidosis on this basis, the later clinical course and the demonstration of acid-fast organisms on smear, and culture of a lymph node confirmed the diagnosis of tuberculous lymphadenitis. It is possible that in this case sarcoidosis evolved into tuberculosis, or that tuberculosis was superimposed on sarcoid disease. However, it is most probable that in this case tuberculosis was misdiagnosed as sarcoidosis and, even more important, that the changes in the bones of the hands and feet, said to be typical of sarcoidosis, do not constitute a reliable diagnostic criterion. The ocular disease was probably also tuberculous.

CASE 5.—L. M., a white woman aged 45, unemployed, was first seen in 1945 in the clinic for diseases of the chest, from which she was referred to the eye clinic. She had had a chronic cough for one year and failing vision for thirteen months. For the past thirteen years she had had widespread lesions of the skin, which involved the face, lids, nose, arms and hands (fig. 5). The cutaneous lesions first appeared as nodules and later turned dark red; some ulcerated and took as long as eight months to heal. They were diagnosed as lesions of sarcoidosis. She stated that thirteen years before, when ulcers first appeared on the arms, her eyes had been sore and red for three months, and then all ocular symptoms had disappeared. About thirteen months prior to admission vision failed rapidly, and on examination she was able to see only patches of light and dark. The past and family histories were noncontributory.

Vision in the right eye was limited to perception of hand movements at 3 feet (90 cm.) and was 20/800 in the left eye. The middle thirds of the lids were badly scarred and notched. A heavy white mucoid exudate was present in each eye. The cilia were missing from the central third of both upper lids. The lids had a brawny edema. The light reflex from the corneal surfaces was "pebbly." Gray mottling involved all layers of the cornea; it was greater in the anterior and middle thirds and faded out toward Descemet's membrane. A moderate aqueous flare was present in each eye. The pupils were entopic, measured 1.5 mm. in diameter and were fixed by thick posterior synechias. Numerous mutton fat keratic precipitates were found on the corneas. No details of the lens or fundus could be seen in the right eye, and no red reflex was visible with the ophthalmoscope. A dull red fundic reflex was present in the left eye. Intraocular tension (Schiøtz) was normal.

An intradermal test gave a negative reaction to 0.1 cc. of undiluted old tuberculin. Routine laboratory tests gave normal results, and the Kahn reaction was negative. Roentgenograms of the hands and feet disclosed rarefactions suggestive of sarcoid disease in the metaphysial regions of the second digit of the right foot and of the second, third and fourth digits of the right hand. Roentgenograms of the sinuses showed a fluid level in the right maxillary sinus. The floor of the left maxillary sinus was obscured, possibly by thick exudate. In the roentgenograms of the chest, a fine fibrotic mottling, extending from the hilus to the periphery of the lung, was present bilaterally, being more marked in the lower lobes. Some calcification was present in the hilus. Repeated roentgenograms of the chest over a period of two years showed a slight, but definite, increase in the amount of pulmonary fibrosis, with formation of multiple fine, rather dense nodulations through the middle third of each lung. This picture was compatible with sarcoid disease. Biopsy of the nasal mucosa revealed hyperplasia of epithelium and a nest of tubercle-like tissue of unknown origin.

In April 1947 the ocular disease was still active. Vision in the right eye was limited to light perception with poor projection; that in the left eye was increased to 8/200. Corneal opacities were unchanged, and numerous keratic precipitates were still present. Routine intradermal tests gave negative reactions.

Diagnostic Criteria.—The patient had widespread lesions of the skin, clinically diagnosed as sarcoid disease. The roentgenograms of the chest suggested sarcoidosis, particularly in view of the negative cutaneous reaction to undiluted old tuberculin. The patient also had keratitis, iritis and osseous lesions suggestive of sarcoidosis. The roentgenograms of the chest, the negative reaction to tuberculin

Fig. 5 (case 5).—Lupus pernio type of Boeck's sarcoidosis, involving the lids, nose, mouth and other portions of the face (March 1946).

and the lesions of bone were considered most indicative of the disease. Permission for biopsy of the skin was not granted.

Case 6.—M. R., an obese Negro housewife aged 40, was first seen in the eye clinic in October 1945. She complained of bronchial asthma of seven years' duration, sinus trouble of four or five years' duration and cutaneous lesions of two years' duration. The lesions of the skin began on the upper portion of the arms and the shoulders, then spread to the back and later over the entire body. At first the lesions were flat, round or ovoid; later they became more irregular in shape, more elevated and larger, and some oozed a clear fluid. In 1942 the patient

began to have severe orbital and temporal headaches, with associated burning of the eyes, a discharge and redness. In 1943 there developed a persistent chronic cough, productive of gray sputum. There was no history of fever. In 1944 she had severe sinusitis, until a transnasal operation gave pronounced symptomatic relief. The patient still complained of a scratchy sensation in both eyes, but no actual pain. There had been a loss in weight of 15 to 20 pounds (6.8 to 9.1 Kg.) in the past two years. The family history was noncontributory.

Ocular examination revealed vision of 20/20 in the right eye and 20/200 in the left eye. A left divergent squint of 30 degrees was present. The conjunctivas were moderately hyperemic. The palpebral conjunctivas were granular as the result of numerous elevated, yellow follicles. Ophthalmoscopic study and examination with the slit lamp revealed no evidence of past or present uveitis. The intraocular tension (Schiøtz) was normal. The symptoms of conjunctivitis increased during the course of later visits. The tarsal conjunctiva became intensely red and covered with numerous tiny hemorrhages, follicles and scars. An early superficial pannus developed on the upper third of the left cornea, with no other evidence of keratitis. Extensive bacteriologic investigation for organisms and inclusion bodies was unsuccessful. After trial use of many common antiseptics, the conjunctiva cleared dramatically with application of a 1 per cent solution of silver nitrate. The pannus, however, persisted.

Biopsy of the nasal mucosa showed bilateral polyposis, unrelated to sarcoidosis. The brown macular lesions of the skin of the face and other parts of the body were irregular in size and were superficially scarred and desquamated. Biopsy of the skin by an eminent pathologist showed tissue similar to that of Boeck's sarcoidosis. Intradermal tests with old tuberculin in a dilution of 1:100 gave a definitely positive reaction. Roentgenograms of the chest showed widespread fibrosis, most marked in both apexes, and multiple calcifications in both hili, with two small, discrete areas of calcification in the periphery of the lower part of the right lung. The impression was that the pulmonary disease was more typical of tuberculosis than of sarcoidosis. Roentgenograms of the hands and feet revealed no lesions. Routine laboratory intradermal tests gave negative reactions.

Diagnostic Criteria.—The patient had conjunctivitis and keratitis with pannus, without uveitis. The lesions of the skin were diagnosed as sarcoidosis, and the roentgenograms of the chest were compatible with the picture of sarcoidosis. The cutaneous reaction to a 1:100 dilution of old tuberculin was positive. The biopsy of the skin was assumed to show lesions of diagnostic importance, and the roentgenographic changes in the chest, coupled with low cutaneous sensitivity to tuberculin, gave additional evidence. The correct interpretation of a positive reaction to intradermal injection of 0.1 cc. of old tuberculin U. S. P. was not clear.

CASE 7.—G. A., a Negro housewife aged 30, was first seen in the eye clinic in July 1946. The patient stated that she had had a lesion of the skin for several years, but had had no ocular trouble until three days prior to her first visit. At that time the left eye became red and had a scratchy sensation. There was no history of serious or chronic illness, cough, fever or loss of weight. The family history was noncontributory.

The right eye was normal. Both the palpebral and the bulbar conjunctiva of the left eye were injected, and there was a frank yellowish, thick mucous discharge. Examination with the slit lamp revealed no evidence of active disease in either eye. The fundi were normal.

Two days after this visit the patient noticed a white mark on her left cornea. On examination it proved to be a white opacity, measuring 1 by 1.5 mm., leukomatous in density and involving the superficial third of the corneal substance, with similar, but small, opacities at 7, 8 and 9 o'clock near the limbus. The cornea did not stain with fluorescein. There was a slight increase in aqueous ray, but no floating cells, edema of the iris or exfoliation of pigment that might indicate beginning uveitis. The diagnosis was keratoconjunctivitis. Smears and culture were free of organisms.

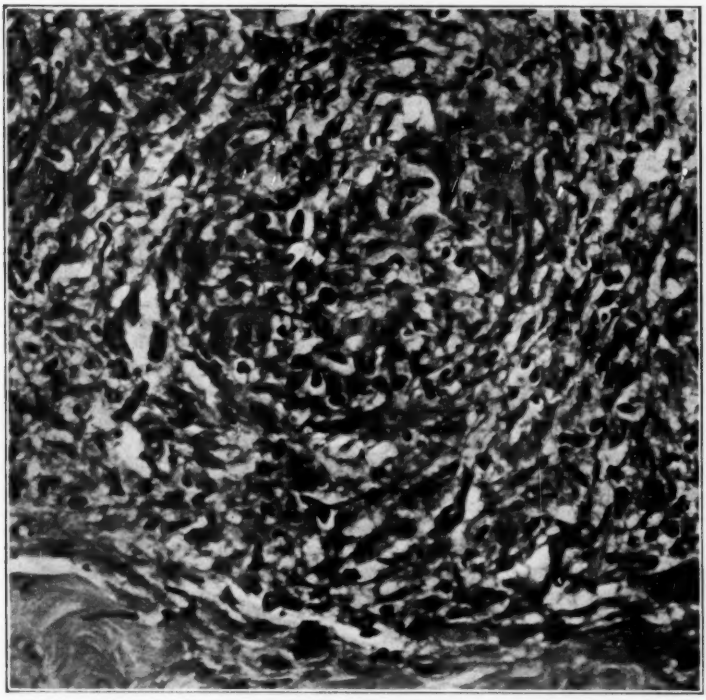


Fig. 6 (case 7).—Biopsy specimen (July 1946) of the skin, showing a non-caseating, closely packed, epithelioid whorl lying adjacent to fatty tissue; × 460.

Two months later the patient came in complaining of pain and redness of the left eye. The aqueous flare had increased to 3 plus; an occasional floating cell, but no keratic precipitates, were seen. Within another month severe exudative and plastic iritis developed in both eyes. Innumerable cells were found in the aqueous, and many fatty keratic precipitates, abundant posterior synechias and fibrin-like deposits were seen on the lenticular capsules. No Koeppe nodules were observed. The opacities of the left cornea were unchanged. The right cornea

remained clear. The fundi showed no abnormalities. The intraocular tension (Schiøtz) was normal. Bacteriologic investigation of the conjunctival discharge revealed a few Staph. aureus organisms. Routine laboratory tests gave normal results, and the reactions to intradermal tests were negative.

Stereoscopic roentgenograms of the chest showed multiple bilateral rounded hilar masses with a few faint, small masses in the upper lobe of the right lung. Roentgenograms of the hands and feet revealed no abnormality. Multiple cutaneous plaques and nodules, slightly elevated, were located on the medial surface of the arms, the buttocks and the posterior and anterior aspects of the thighs. These lesions had a magenta cast, with slight scaling. Biopsy of the skin showed Boeck's sarcoidosis (fig. 6). Intradermal injections of old tuberculin gave negative reactions through strengths of 1:1,000, but there was no opportunity to carry the tests further. Examination of the nose did not show pathologic changes; no biopsy specimen was taken. In spite of the extensive involvement of the anterior segments, vision remained 20/50 in the right eye and 20/30 in the left eye.

Diagnostic Criteria.—The patient had iritis followed by keratoconjunctivitis. Intradermal injection of old tuberculin in a dilution of 1:1,000 gave no reaction. There was no opportunity for tests in lower dilutions. Biopsy observations on the skin were accepted as being highly indicative of sarcoidosis, and the roentgenograms of the chest as being equally suggestive in the absence of clinical evidence of other disease. Taken alone, the roentgenograms suggested the possibility of Hodgkin's disease, but considered together with the ocular involvement, they were interpreted as showing sarcoidosis. If the reaction to tuberculin had been positive, the possibility of caseous hilar tuberculosis would have been considered.

Case 8.—E. G., a white housewife aged 25, was first seen in the eye clinic in March 1936, with the complaint of blurred vision in the right eye of five months' duration; there was no history of other ocular disturbance. She had not had chronic cough, fever, periods of weakness or loss of weight. The past and family histories were noncontributory.

Examination of the right eye revealed a clear cornea but definite injection of the bulbar conjunctiva. Deposited on the corneal endothelium were numerous mutton fat keratic precipitates. The aqueous contained about 30 cells per small pinhole fields of the slit lamp. The iris was dull, muddy, greenish blue and nodular. One large nodule extended from the root of the iris almost to the pupillary border; it had a raised, rounded surface; a muddy, dull brownish-gray color, and new-formed, superficial vessels. Three small nodules were seen at the pupillary margin. There were numerous posterior synechias. Precipitates occurred on the anterior capsule of the lens. The fundus was normal.

In the left eye the cyclitis was less intense. The iris was a clearer blue and without nodules; the fundus was normal. Vision was 20/100 in the right eye and 20/15 in the left eye. Intraocular tension (Schiøtz) was normal in each eye. The patient was seen frequently until May 1941, when vision was 20/40 in her right eye and was limited to perception of hand movements at 8 inches (240 cm.) in the left eye. In the right cornea a nebulous, opacity, 1 by 1.5 mm., involved the deeper third of the stroma at the vertex. The aqueous still showed a slightly increased ray, but the cells and keratic precipitates had disappeared. The iris presented numerous posterior synechias and many atrophic areas corresponding to the location of the former nodules. The new vessels of the iris persisted. A retinal area, ⅛ D. in diameter, at the macula was characterized by its light orange color and central clumping of pigment. In the

left eye a diffuse, hazy, nebulous opacity was located in the deeper third of the cornea and involved the lower half of the corneal area. The iris was atrophic; ring synechias were connected with flaky, fibrous veils that covered the pupillary opening. This pupillary material was crossed by numerous fine blood vessels. The left lens was densely cataractous. The intraocular tension (Schiøtz) was normal.

No reaction was obtained with 1.0 cc. of undiluted old tuberculin. The tonsils, removed in 1936, showed only chronic follicular tonsillitis, without evidence of tuberculosis or sarcoidosis.

The sequence of events during the course of the pulmonary disease was remarkable. The chest appeared normal in March and October 1936. In April 1937 bilateral increased density of hilar glands and bronchovascular markings had developed. In May 1937 the enlarged lymph nodes in the hilar region suggested Hodgkin's disease. In February 1938 the hilar lymph nodes regressed in size and the lungs became clear. By March 1941 the chest again appeared normal, and roentgenograms of the bones of the hands and feet at that time showed no abnormalities. The results of routine laboratory tests were normal, and intradermal tests gave no reactions. In 1939 the spleen and the superficial lymph nodes, except for the cervical nodes, became enlarged. An inguinal node removed at another hospital, showed a tuberculous structure. Examiners of the same slide at this clinic stated the opinion that the section was suggestive of sarcoidosis.

Diagnostic Criteria.—This case was the only one in which keratitis and anterior uveitis preceded the pulmonary disease. It was also of interest that the chest, the findings in which were indicative of hilar sarcoid disease (as well as Hodgkin's disease) at one stage, returned to a normal appearance. The opinion was expressed by the roentgenologists that such complete clearing would have been impossible had the disease been either tuberculosis or Hodgkin's disease and, for that reason, was strongly indicative of sarcoidosis. The pulmonary disease and the negative cutaneous reaction to undiluted old tuberculin were of first importance in the diagnosis in this case. The nodular type of iritis was more significant than the seroplastic type. The keratitis was noteworthy. Biopsy of the lymph node resulted in controversial reports.

Case 9.—M. G., a white man aged 35, a laborer, was first seen in the eye clinic in September 1944. He stated that his left eye had first become red six months previously but had never been painful. He had been treated by several physicians. Two weeks before, he experienced a sudden decrease in vision and pain in the right eye. He gave no history of illness, chronic cough, fever, weakness or loss of weight. His past and family histories were noncontributory.

There was pronounced loss of vision, visual acuity being 2/200 in the right eye and 1/400 in the left eye. Both eyes had a moderately intense mixed injection of the ball, which was mostly ciliary. The caruncles were injected and swollen. Both corneas presented the following picture: There was a horizontal, bandlike macula. The opacities involved the deeper two thirds of the stroma and extended over half the cornea. The opacity of the cornea was greater in the lower than in the upper half. The epithelium was smooth and did not stain with fluorescein. There was no vascular infiltration. Many mutton fat keratic precipitates were deposited on the endothelium.

The anterior chamber was deep. Each eye showed posterior synechias of ring-like distribution, with entropion iridis and some tendency to iris bombée. New vessels appeared on the surface of the iris, and the pupillary aperture was well

filled with a light gray membrane. A moderately mature, complicated cataract was present in each eye. Neither fundus could be visualized, but a good red reflex was obtained in each eye. The intraocular tension (Schiøtz) was normal in each eye.

The laboratory tests gave normal results, and the Kahn reaction was negative. Intradermal tests with old tuberculin gave positive reactions in dilutions up to 1:100 and negative reactions to greater dilutions. Other cutaneous tests gave negative reactions. Physical examination revealed enlargement of the superficial inguinal lymph nodes on both sides. There were no cutaneous lesions. Biopsy of an inguinal node showed markedly disrupted architecture (fig. 7). Throughout the node were areas of cells characterized by plentiful bluish to clear cytoplasm

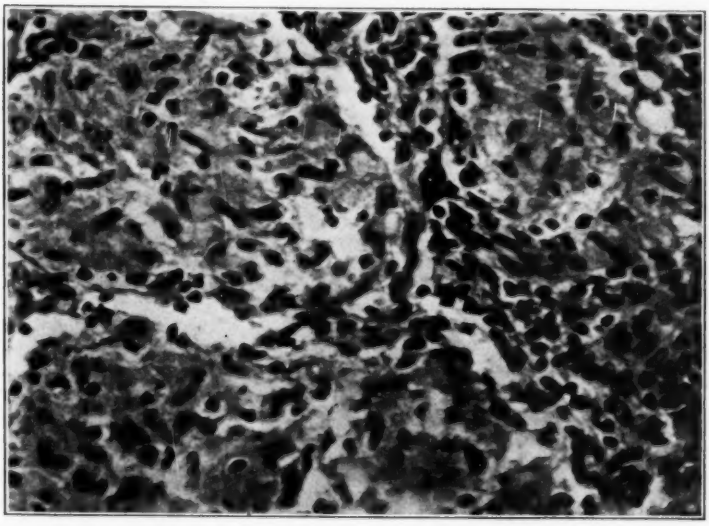


Fig. 7 (case 9).—Biopsy specimen of an inguinal lymph node (October 1944), showing multiple noncaseating epithelioid whorls, compatible with the diagnosis of Boeck's sarcoidosis; × 460.

and one to three round, ovoid or sausage-shaped nuclei with light, fine chromatic stippling. The cells were arranged in swirls and masses, strongly resembling early tuberculoid formation. In large areas thick strands of collagenous substance twisted through them. No giant cells or areas of caseation or necrosis were seen. A few mitotic figures were present. The remaining lymphoid structure was normal. The impression was that of early tuberculosis of the lymph node or of possible Boeck's sarcoidosis. Stereoscopic roentgenograms of the chest were of special interest. In September 1944 roentgenograms showed dense bilateral hilar infiltrations which spread along the bronchovascular markings into each adjacent pulmonary field (fig. 8*A*). The picture resembled that of pulmonary sarcoidosis. Roentgenograms of the bones of the hands and feet were normal. Six months

later there was slight lessening of the hilar density; the bones of the hands and feet were still normal. In October 1945 roentgenograms showed that there had been complete clearing of the lesions previously noted (fig. 8 *B*). The chest appeared normal.

Diagnostic Criteria.—Clinical evidence of sarcoidosis consisted of two factors: histopathologic changes in the lymph nodes compatible with sarcoid disease, and, most important, a typical roentgenologic picture of dense hilar nodules with bilateral fanning out of the bronchial vascular markings. Later roentgenograms showed clearing of the chest to a normal appearance. The roentgenologists stated the belief that such clearing would be impossible in a case either of ordinary

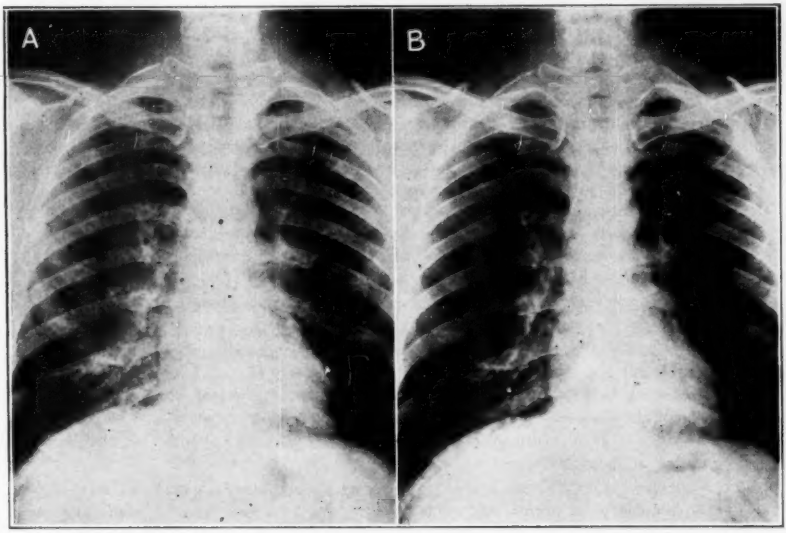


Fig. 8 (case 9).—*A*, roentgenogram of the chest (September 1944), showing marked hilar and parenchymal infiltrations, suggestive of Boeck's sarcoidosis; *B*, roentgenogram of the same chest as that shown in *A*, now with complete clearing and a normal appearance (October 1945).

tuberculosis or of Hodgkin's disease. The cutaneous sensitivity to tuberculin in dilutions of 1:100 was unexplained. The corneal opacities were the densest noted in any case reported here.

Case 10.—A. W., a white housewife aged 42, was first seen in the eye clinic in March 1929. The patient stated that burning and itching of the right eye had begun three months previously and that one month later similar symptoms had developed in the left eye. There had been some tearing but no discharge. Vision was not affected at first, but later it was greatly decreased. There was no history of chronic or severe illness, chronic cough, fever, loss of weight or contact with tuberculous persons. The family history was noncontributory.

Vision was 2/200 in the right eye and was limited to counting fingers at 4 feet (120 cm.) in the left eye. In the right eye, there was a heavy ciliary injection, and a central corneal opacity involved the anterior third of the cornea. The central leukoma faded to a macula toward the periphery. A superficial pannus extended over the limbus for 2 mm., without reaching the central opacity. The anterior chamber was of normal depth. Many mutton fat keratic precipitates, an increased aqueous ray and a few floating cells were seen. Posterior annular synechias were present, but there were sufficient openings to prevent the formation of iris bombée. The iris showed translucent, yellowish white nodules, 0.5 to 1.5 mm. in diameter, with vascularization about their bases. The pupillary aperture was filled with a cloudy, flocculent material. The fundus was normal.

The left eye presented a similar picture of central corneal opacity, aqueous cells, precipitates, synechias and cloudy material in the pupil. Intraocular tension (Schiøtz) was normal. No tubercle bacilli were found after inoculations of guinea pigs with the aspirated contents of the anterior chamber of the right eye.

In 1936, after a stormy bilateral iritis, only a small central opacity in the anterior third of the cornea, with a definite Stahli line below, remained in each eye. The nodules of the iris disappeared, leaving marked atrophy. The pupils were fixed by annular synechias. The aqueous was clear. The moderate visual loss, with acuity of 20/30 in each eye, was caused by incipient complicated cataract. The fundi were normal. Routine laboratory tests revealed nothing significant and intradermal tests with old tuberculin gave reactions in dilutions of 1:100 and lower. A few macular lesions of the skin, diagnosed as tuberculids, developed on the face, arms and legs.

The sequence of events in the course of the pulmonary disease was unusual. A few of the many reports are summarized as follows:

March 1929: High grade tuberculosis of the hilar glands, particularly on the right side.

December 1929: Hilar tuberculosis; regression over a period of nine months ruled out the diagnosis of a malignant growth.

September 1930: Bilateral hilar tuberculosis, showing definite, but slight, parenchymal spread.

February 1931: Frank spread of tuberculosis into the parenchyma of the lung; fair degree of fibrosis and some calcification; advanced bilateral pulmonary tuberculosis of predominantly fibrous type, which had developed by spread from the hiluses.

June 1932: Slight increase in the fibroid type of tuberculosis; no notable changes from the February findings.

February 1933: An essentially unchanged appearance of advanced bilateral fibroid tuberculosis.

February 1934: Evidence of improvement in the upper lobe of the right lung; no change in the other pulmonary fields.

November 1935: Unchanged picture of bilateral pulmonary tuberculosis, predominantly fibrotic.

September 1936: Considerable emphysema; condition otherwise unchanged.

October 1936: Unchanged picture of atypical fibroid tuberculosis.

December 1937: Pneumonia superimposed on diffuse fibrous tuberculosis (pneumonia cleared uneventfully in a few weeks).

September 1939: No change in fibrotic lesions.

December 1939: Roentgenograms of bones of the hands and feet for the first time showed areas of rarefaction, with no evidence of sclerosis, in the triangular bones of the right wrist and anterior portion of the calcaneus and in the cuboid of the right foot. There were similar, but much less definite, areas of rarefaction in the navicular and lesser multangular bones of the left wrist. No changes in the phalanges of the hands were seen. These areas of rarefaction, without accompanying sclerosis of bone, are said to be characteristic of Schaumann's disease (sarcoidosis) and are usually found in the phalanges, rather than in the carpal and tarsal bones. A presumptive diagnosis of lesions of bone of Schaumann's disease was made.

October 1941: No change in lesions of the chest or bones.

In October 1947, the patient returned to the eye clinic, after an absence of six years. She appeared well and stated that she felt well and strong. Vision was 20/20 in the right eye and 20/30 in the left eye. In the right eye a central corneal nebula, 3 mm. in diameter, involved all layers, but chiefly Bowman's membrane. A highly refractile leukoma, 0.5 mm. in diameter, resembling a fatty infiltration, lay in the center of the nebula. The endothelium showed old deposits of pigment. Stahli's line below the opacity was well developed. Posterior synechias remained as thin, gray veils, and the pupillary opening was occluded; the iris was highly atrophic. In the left eye a highly refractile central corneal opacity, 0.5 mm. in diameter, involved the deeper epithelium and Bowman's membrane. Thin gray synechias continued as a veil over the pupil, and the iris was atrophic. The fundi were normal.

Diagnostic Criteria.—The patient had keratitis and nodular iritis. A series of roentgenograms of the chest over a period of eighteen years were diagnosed consistently as showing tuberculosis, even though the patient was sensitive to old tuberculin only in dilutions of 1:100. Lesions of bone, compatible in appearance with those of sarcoidosis, were observed in 1939, and at that time the diagnosis was changed to sarcoid disease. The fact that this woman had remained well in spite of the widespread pulmonary disease added credence to the diagnosis of Boeck's sarcoidosis.

COMMENT

The number of cases reported here is not large, and for that reason statistics must necessarily be inaccurate. Such a large series of as many cases of Boeck's sarcoidosis, with abundant ocular complications, is, however, infrequent in current ophthalmologic literature, and this report may add to present factual information.

Frequency.—Boeck's sarcoidosis appears to be a rare disease, but its exact incidence is not easily determined. In clinics of this university only about 30 cases are being followed with any degree of regularity, and this small number has been gleaned from over 450,000 registrations since 1927. The low incidence may be due to several factors: (1) This clinic is not a charity dispensary; (2) the social status of the patients seen is probably above the average, and (3) the percentage of Negro patients is small. It is also possible that there is some reticence among clinicians in making a diagnosis of Boeck's sarcoid. In 10 of the 30 cases of sarcoidosis collected from all clinic

patients in this university the eyes were involved. Eight of the 10 patients with ocular involvement were females. Five of the 10 were Negroes. Since Negro patients comprise about 1 per cent of the total daily number of patients who come to the clinics, it would appear that sarcoidosis is many times as frequent in the Negro race as in the white race, at least in this part of Chicago. The youngest patient was 25 years of age and the oldest 59; the average age was 36 years.

Earliest Symptoms.—Of the 10 cases, ocular symptoms were first noticed in 8, cutaneous lesions in 1 and symptoms referable to the chest in 1. The occasion for the first medical consultation corresponded exactly with the symptoms.

Nonocular Disease.—Pulmonary disease was present in all 10 cases; cutaneous lesions were noted in 6 cases; the lymph nodes were involved in 4, concurrent sinus disease was present in 3, and lesions of the bone were noted in 3.

Ocular Symptoms.—Lids: In 2 of the 10 cases there were extensive lesions of the lids. In case 4 both upper lids revealed intracutaneous papules. In case 5 lids showed brawny edema with subcutaneous nodules in the upper lids, accompanied with central notching and loss of cilia (fig. 5).

Conjunctiva and Cornea: These two tissues are discussed together because of the intimate relation of the symptoms and signs of conjunctivitis and keratitis found in 6 of the 10 cases. It is interesting to note that 7 of the 10 patients described their first symptoms as redness, itching and scratching. This is not significant in itself but assumes more importance when it is correlated with the earliest symptoms. In both cases 2 and 5 there was a heavy mucoid discharge, and in cases 4, 5, 6, 7, 8 and 9, conjunctival disease, which varied from intense hyperemia, swollen caruncles and follicles to conjunctival hemorrhages. Varying degrees of corneal involvement were also noted in cases 4, 5, 6, 7, 8, 9 and 10. Sclerosing keratitis occurred in case 4; corneal opacities, in cases 5, 7, 8 and 10; pannus, in case 6, and heavy band-shaped keratitis, in case 10. It might be argued that the corneal disease was only a complication of severe anterior uveitis. Such an opinion was given in the recent literature by other authors; however, the evidence presented here indicates that both the conjunctivitis and the keratitis are probably primary involvements, since corneal disease is not seen in 70 per cent of cases of heterogeneous anterior uveitis. Most important of all, in 3 cases there was definite corneal disease without evidence of past or present anterior uveitis. In case 4 there were a pannus and corneal opacities without evidence

of previous anterior uveitis. In case 6 the left eye showed extensive pannus without evidence of anterior uveitis. There were extensive corneal opacities in case 7, and while the patient was under observation uveitis developed in the left eye.

Careful study of the histories and the earliest symptoms of ocular disease in these cases indicated that the sequence of events is probably that of an early conjunctivitis, followed by keratitis of varying degrees of severity, with the uveitis concurrent with, or not infrequently following, the conjunctivitis or keratitis. The idea cannot be entirely disregarded that the uveitis may be caused by corneal penetration by an unkown organism or toxic material.

Anterior Uveitis: Anterior uveitis existed in 9 of the 10 cases. In only 2 of these cases was it of the nodular type, whereas in 7 it was of the seroplastic type. In 2 cases the uveitis remained unilateral for nine months and two years, respectively, without evidence in the contralateral eye. In 7 of the 9 cases the uveitis became bilateral. Abundant keratic precipitates of the mutton fat type were characteristic of all cases of anterior uveitis. Heavy ring synechias were also present in all cases of uveitis, but in no case in this series did iris bombée actually develop. In several cases it seemed that such a complication would be inevitable, but at least one small channel between the posterior and the anterior chamber remained open. This feature appears to be characteristic of the iritis associated with sarcoidosis. Iridic atrophy was frequently observed in the later, quiescent stages. The nodular type of iritis, especially, seemed to lead to advanced atrophy of the iris.

Chorioretinitis: A chorioretinal lesion occurred in only one eye (case 8). Since this lesion was not proved to be active during the course of the general disease, it was only assumed that the ocular disease was due to sarcoidosis.

Complicated Cataract: Definite complicated cataract occurred in only 3 cases. In case 9 both eyes exhibited only moderate cataractous changes, and in case 8 one eye had a dense cataract. From these findings it would appear that, in spite of the severity of the anterior uveitis, complicated cataract is not frequent.

Tension: The intraocular tension, measured by the Schiøtz instrument, remained normal in all cases. In case 1 the tension of one eye mounted to 30 mm. of mercury, the highest reading obtained for any eye. It returned to normal limits within one week on cessation of instillation of atropine. The use of the atropine was then continued, without further rise.

Vision: Visual acuities on last examination, with the approximate length of time each eye was known to be diseased, are tabulated for each case.

Case Number	Right Eye		Left Eye	
	Vision	Duration of Disease	Vision	Duration of Disease
1	20/16	1 yr.	Hand movements	1 yr.
2	20/100	1 yr.	20/25	Not involved
3	20/70	2 yr.	20/25	21 mo.
4	20/16	Not known	Light perception	3 yr.
5	Light perception	3 yr.	8/200	3 yr.
6	20/20	3 yr.	20/100	3 yr.
7	20/50	1 yr.	20/30	1 yr.
8	20/40	12 yr.	Hand movements	12 yr.
9	2/200	6 mo.	1/400	Few wk.
10	20/20	18 yr.	20/30	18 yr.

It was encouraging to note that if corneal opacifications did not develop the prognosis for reasonably good vision was excellent. If the eyes with keratitis and the eye with the large tumor are not included (cases 1, 4, 5, 6 and 8), the average vision for the involved eyes of this group was about 20/30, and no eye had vision of less than 20/100. One patient who had had severe bilateral uveitis for eighteen years retained 20/20 vision in the right eye and 20/30 vision in the left eye. The prognosis was not favorable for eyes with corneal involvement. These eyes had residual visions of light perception, 2/200, light perception, 8/200, hand movements and 1/400, respectively.

Treatment of Ocular Complications.—Since beneficial drugs had not been found, therapy was largely directed toward empiric treatment of the iritis. The chief aim was to prevent the formation of heavy synechias with a small pupil, which might result in filling of the pupillary aperture with organized exudates. In every case of iritis a 1 per cent solution of atropine sulfate was given several times a day. In no instance was the formation of posterior synechias prevented, even with a widely dilated pupil. It was found that the swelling of the iris was so great and the exudates so abundant that posterior ring synechias were formed, regardless of treatment. However, with this mydriasis, reasonably good pupillary opening was obtained in almost every case. Neither the atropine nor the disease produced secondary glaucoma.

General Treatment.—A modification of the regimen of rest for tuberculosis seemed to be in order. Nothing is known of the contagious aspect of the disease, but it should probably be considered

contagious until proved otherwise. Radiation therapy has been tried both for the cutaneous lesions and for the hilar nodes of the lungs, without conclusive results. Calciferol (a pure crystalline form of vitamin D_2) holds some promise of being beneficial. Dermatologists have used it in all their recent cases of sarcoidosis in doses of 50,000 international units of vitamin D three times a day, with promising results so far as the cutaneous lesions are concerned. A few patients suffered from nausea with this dose, but no other untoward results were noted. Calciferol was used in the last current case of iritis complicating sarcoidosis (case 2). Shortly after the use of calciferol, an extremely painful iritis became painless, and definite clearing of the aqueous began. From this single case, it cannot be stated whether the remission was coincidental or was due to the calciferol. Although cod liver oil was recommended for the treatment of lupus vulgaris in the latter part of the eighteenth century and solar therapy has long been advocated, it remained for Charpy,[16] in France, and Dowling and Thomas,[17] in England, to appreciate the probable effects of massive doses of vitamin D_2. This work is considered by some to be the most important contribution to dermatology in recent years.

SUMMARY AND CONCLUSIONS

Boeck's sarcoidosis is discussed with regard to the many uncertainties in establishment of a clinical diagnosis. It has been demonstrated in the 10 cases reported here and in the writings of others that no single criterion or group of criteria exist to make possible a conclusive diagnosis of the disease. It is shown that experienced and well qualified specialists may disagree on the interpretation of the tissue biopsy and the gross appearance of lesions of the skin, eye or chest. Sarcoidosis is chiefly confused, usually on the basis of incomplete evidence, with tuberculosis, and less often with Hogkin's disease, syphilis, neoplasms, silicosis, leukemias, leprosy and other forms of lymphoblastoma.

Most important for a correct diagnosis of sarcoidosis are a good history of the disease; clinical evidence of diseases simulating sarcoidosis; low cutaneous sensitivity to intracutaneous injection of old tuberculin; biopsy of the skin; lesions of bone, as demonstrated in roentgenograms of the hands and feet; roentgenograms of the chest; biopsy of lymph nodes; gross appearance of cutaneous lesions; examination of the blood for albumin-globulin ratio, and ocular exami-

16. Charpy, M. J.: Le traitement des tuberculoses cutanées par la vitamine D_2 à hautes doses, Ann. de dermat. et syph. **6**:310-346, 1946.

17. Dowling, G. B., and Thomas, E. W. P.: Treatment of Lupus Vulgaris with Calciferol, Lancet **1**:919-922 (June 22) 1946.

nation, the items being listed in the approximate order of their reliability. It is of value to be able to detect more than one type of sarcoid lesion, but this advantage is equivocal in that, singly or in combination, the lesions do not necessarily establish a reliable basis for diagnosis. In the light of present knowledge, it is a matter of good judgment to be conservative in suggesting a diagnosis of sarcoidosis, for it is probable that many cases have been presented as instances of this disease with incomplete evidence. Each finding must be carefully evaluated as to whether it may strongly suggest, or only be compatible with the diagnosis of Boeck's sarcoidosis, and attention must be given to the question whether the experience and reputation of the reporting physician may justify a reliable opinion.

Ocular disease was present in approximately one third of the cases of sarcoidosis. The usual sequence of events for the ocular disease found in this series was the appearance of conjunctivitis, followed by some degree of keratitis, with anterior uvetitis ocurring with the conjunctivitis or keratitis, or following at a later period. Secondary glaucoma was not observed; complicated cataract was infrequent, and chorioretinitis was rare. The prognosis for good vision was excellent, even though the anterior uveitis was severe and active for many years. This, however, was true only in cases without corneal opacification.

Regardless of whether the physician wishes to think of sarcoidosis as a separate clinical entity or as a form of attenuated tuberculosis, from the standpoint of prognosis and possible differential treatment, the diagnosis of Boeck's sarcoidosis should be made whenever careful evaluation of the evidence may warrant a reasonably positive conclusion. Because the ophthalmologist is usually the first medical consultant, it is his obligation to recognize the possibility of sarcoidosis and to guide the patient to the necessary specialists for the confirmation or disproof of that diagnosis.

The University Clinics.

OCULAR FINDINGS IN THREE HUNDRED AND TWENTY-THREE PATIENTS WITH SCHIZOPHRENIA

A Preliminary Report

MARTIN COHEN, M.D.
NEW YORK

THREE FACTS in connection with schizophrenia prompted this study: the prevalence and gravity of this mental ailment, the absence of recent ophthalmoscopic reports and the lack of micropathologic descriptions of the optic disk in cases of schizophrenia. New York state has twenty state hospitals for the mentally ill, with an average total population of 85,000 patients, of whom approximately 25 per cent are schizophrenic. Their treatment and care constitute an important medical, social and economic problem.

Although, in the past, there has been important research to determine the possible existence of pathologic changes in the nervous system and other organs in schizophrenia, little has been reported concerning the ophthalmologic findings. In general, studies of the fundus have not been considered in cases of mental disorders. Modern textbooks and other medical literature on psychiatry do not mention the ophthalmoscopic picture in schizophrenic patients.

In 1912, Tyson and Clark [1] included examinations of the fundus in their study of 115 cases of dementia precox at Manhattan State Hospital and found pallor of the optic disk in many. Since then, there have been no organized studies along these lines.

PRESENT STUDY

Material and Method.—The group of 323 patients consisted of 243 men and 80 women, whose ages ranged from 18 to 77 years, most of them being in the younger and middle aged groups. The difference in the ocular conditions of the age groups will be discussed later. The patients were ambulatory and well nourished and presented the clinical manifestations of schizophrenia. The group represented the four types of schizophrenia: catatonic, 18 patients; paranoid, 249 patients; hebephrenic, 48 patients, and simple, 10 patients. The ocular findings did not differentiate one type from another. The patients were

Read before the Section on Ophthalmology of the New York Academy of Medicine, March 15, 1948.

1. Tyson, H. H., and Clark, L. P.: The Eye Syndrome of Dementia Praecox, Arch. Ophth. **41**:223-234, 1912.

all free from systemic or infectious diseases, and none used alcohol or drugs to excess. Patients with any local ocular disease of primary or secondary origin or with myopia causing pallor of the disk were excluded.

A neuro-ophthalmologic examination was conducted on all patients with respect to ocular muscles; pupillary light reaction; gross visual fields, when possible; tension; exophthalmos; nystagmus, and ptosis. These tests were of negative value, as the findings and reactions were normal, particularly the pupillary responses. For the sake of continuity, I shall recall the pertinent anatomic facts.

Examinations of the fundus reveal the outgrowth of the brain tissue, namely, the optic nerve head and the retina, with its blood supply. The central retinal blood vessels and the capillary network on the surface of the optic nerve head or optic disk are in close anatomic connection with the cerebral and general circulation. The optic disk consists of nonmedullated nerve fibers, originating in the ganglion cells of the retina. These retinal nerve fibers continue their course through the visual pathway, that is, the optic disk, chiasm and optic tract, and terminate mainly in the external geniculate body, located in the midbrain. From this junction, fresh nerve fibers, known as optic radiations, transmit the visual impulses to the ganglion cells in the cortex of the occipital lobe. Located in the center of the normal disk is the physiologic cup, consisting of perforations in the connective tissue membrane, the lamina cribrosa. The cup is brilliant white and at times is enlarged, so that the reflection from it may interfere with recognition of the normal color of the disk. On its inner side can be seen the nasal portion of the disk; on its outer side, the temporal portion. The border of the disk is sharply outlined. The normal color of the disk, as well recognized, is pinkish on its nasal portion, shading to a lighter pink on the temporal portion. This color varies with several factors, chiefly the intensity of the luminosity of the ophthalmoscope and the nature of the structure and vascularity of the disk. Variations in the normal color are well known and exist within physiologic limits. To judge whether variations are normal or abnormal requires experience and training in recognizing the variations in color of the disk in normal fundi. If the variation in color is normal, the results of the tests of visual acuity and visual fields will be normal. However, these tests are not applicable to schizophrenic patients, as the answers of these subjects are generally unreliable.

If a degenerative or inflammatory condition is present in the optic disk, this lesion, as seen with the opththalmoscope, serves as a visible guide to diseases of the central nervous system, such as tabes, multiple sclerosis, alcohol poisoning and cerebral tumors. While engaged in this study of the eyegrounds in patients with schizophrenia, I noted especially a brown-gray color of the optic disk. Otherwise the fundus was normal. This color differed from the normal, as well as from the distinct gray or white of partial or complete optic nerve atrophy, as seen in cases of tabes or multiple sclerosis. This tawny gray color was, as a rule, present in both eyes, although in a few cases the disk of the right eye was more involved than that of the left. The reason for this difference could not be ascertained.

The cause of this discoloration could not be determined, as no neuropathologic examinations were available and no mention was found in the literature of any neuropathologic studies of the disk or retina in patients with schizophrenia. It cannot be stated at present whether this discoloration progresses, regresses or remains stationary; one will have to await the results of future investigations.

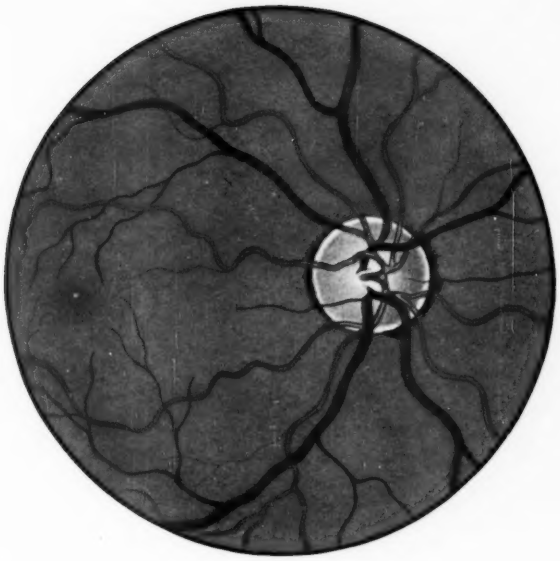


Fig. 1

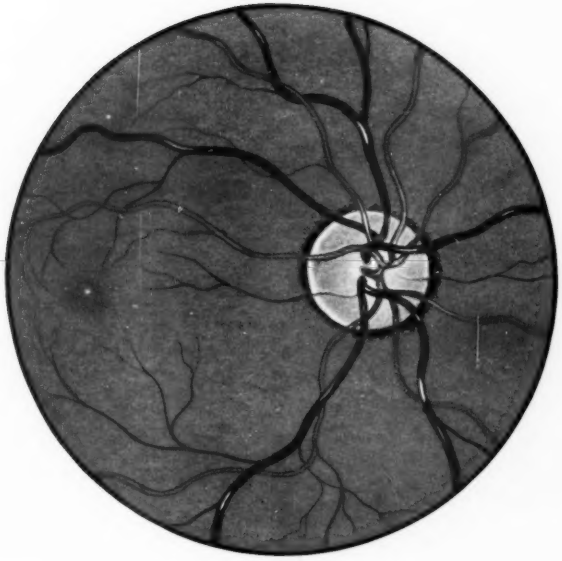


Fig. 2

Fig. 1. Marked Temporal Disc Discoloration.
Fig. 2. Diffuse Disc Discoloration.

Thirty-four of the patients originally examined were intermittently reexamined over a period of six months; in 25 of these the condition of the disks seemed to have remained stationary, while in 9 the discoloration had become more pronounced. All the patients reexamined were under 40 years of age, and they were chosen for reexamination because all of them had shown either a temporal or a diffuse tawny gray discoloration of the disk.

The difficult task of selecting these 323 schizophrenic patients from the hospital wards was undertaken by Dr. Nobe E. Stein. Preparation for the examination consisted of instilling on the conjunctiva 2 drops of a 2 per cent solution of homatropine hydrobromide to facilitate observation of the fundus. Prior to examination of each group, I observed the fundi of several nurses with normal eyegrounds for the purpose of control and of testing the luminosity of the hand ophthalmoscope.

Patients were directed to look straight forward while the light from the ophthalmoscope was directed toward the optic disk in order that any difference in light or color reflections might be avoided. The light from the ophthalmoscope was of moderate intensity. A giantscope conducted on house current controlled by rheostat gives a more constant and more easily regulated illumination than does the generally used hand ophthalmoscope. Unfortunately, the instrument was not available for this study.

Relation of Age to Color of the Optic Disk in Patients with Schizophrenia

Appearance of Optic Disks	Number of Patients Examined in Various Age Groups (Years)				
	Under 30	30-39	40-49	50-59	Over 60
Total number of patients	37	48	86	89	63
Normal color	14	19	36	17	14
Strong temporal discoloration	16	12	21	24	11
Diffuse discoloration	7	17	29	48	38
Percentage of patients showing discoloration	61	60	58	81	78

Approximately 15 schizophrenic patients were examined each week for several months. The results of the examination were dictated for the records. Through the courtesy of Dr. John H. Travis, I was privileged to conduct this study at Manhattan State Hospital, beginning in May 1947.

Results.—In 100 patients (31 per cent) the color of the disks was normal; 84 (26 per cent) showed a pronounced brown-gray discoloration of the temporal portion of the disk (fig. 1), while in 139 (43 per cent) the discoloration was diffuse or complete (fig. 2). These findings indicate either a pronounced temporal or a diffuse discoloration in 223 patients (69 per cent). This is an unusually high incidence of abnormality of color. In the older patients, the brown-gray color might be attributed to vascular changes due to arteriosclerosis, but the retinal vasculature in these patients was normal. The percentage of young and middle-aged patients with discoloration of the disks must be considered excessive, since 102 of 171 patients under 50 years of age (60 per cent) showed this brown-gray color. Data on the relation of age to color of the disk are presented in the accompanying table.

COMMENT AND CONCLUSION

Since these observations on the fundus were personal, several ophthalmologists were requested to express their opinion regarding the changes in the optic disk. The majority of them confirmed the correctness of my observations.

Since the present study was concerned solely with schizophrenia, it is impossible to state whether changes in the optic disk are associated with other psychotic disorders. This phase of the subject will be reported on in a subsequent paper. The discoloration of the disk may be due to a dengenerative, inflammatory, vascular, metabolic or toxic process affecting the optic nerve head. As previously stated, a neuropathologic examination of the disk in schizophrenic patients might serve to clarify the underlying cause of the discoloration.

In conclusion, the ophthalmologic manifestations and clinical findings suggest the probable existence of a pathologic process affecting the visual pathway in the brain of schizophrenic patients.

29 East Sixty-Fourth Street (21).

RESERVE ACCOMMODATION

HARRY EGGERS, M.D.
NEW YORK

WEAKNESS of the accommodation is a frequent cause of asthenopia and should be tested for during refraction. There are various ways of doing this. I have devised a modification of the test for relative accommodation which I believe to be both rapid and reliable for clinical purposes.

CAUSES OF ACCOMMODATIVE IMPAIRMENT

Accommodation may be difficult for several reasons. Three factors largely govern its ease of performance: the plasticity of the lens, the integrity of the innervation and the contractile power of the ciliary muscle.

Experience has shown that the full force of the ciliary muscle can be exerted for only a short interval without fatigue and resultant asthenopic symptoms. The increased contraction that is required in hypermetropia may be beyond the ability of the ciliary muscle to sustain for any length of time. In presbyopia the ciliary muscle does not seem to be lacking appreciably in actual contractile power, but the hardened lens substance resists the molding action of the elastic capsule and an increased muscular contraction is required to relax the restraining zonule sufficiently further to give increased molding force to the compressing capsule.[1] Since the organs of the human body do not age at a common rate, presbyopia may appear earlier than either the general appearance or the chronologic age of a person would suggest.

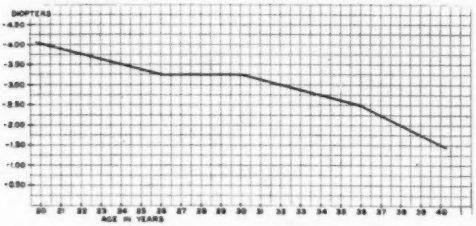
In diphtheria and botulism, toxins are believed to affect the cells of the Edinger-Westphal part of the oculomotor nucleus, or perhaps the cells in the ciliary ganglion. In syphilis, encephalitis lethargica and other infectious diseases, inflammatory lesions occur in or near the oculomotor nucleus. In the debility and avitaminosis of malnutrition or systemic disease, the fibers of the third nerve may be directly affected by degenerative changes which appear first in the myelin sheaths and later extend to the axis-cylinders. The ciliary muscle itself may be weakened whenever there is generalized muscular weak-

1. I follow Fincham's theory of accommodation.

ness. Bacterial tonsillar or dental focal infection also weakens the accommodation. The modus operandi of such focal infection is not known.

MEASUREMENT OF THE RESERVE ACCOMMODATION

In order to determine the normal values, I measured the reserve accommodation of over 2,000 adults, who were about equally divided between the sexes. All these persons did at least three hours of fairly continuous reading or close work each day. The subjects were divided into two groups of approximately equal numbers—those with and those without symptoms of accommodative asthenopia. All persons with complaints that might be attributed to muscle imbalances or uncorrected astigmatism were excluded. For each group plottings were made on cross sectional paper, the ordinates representing diopters



Graph showing minimum normal additional accommodation, expressed in diopters, at a distance of 11 inches (28 cm.) for persons of various ages.

Minimum Values for Reserve Accommodation at Distance of 11 Inches

Age, Years	Reserve Accommodation, Diopters	Age, Years	Reserve Accommodation, Diopters
20	—4.00	32	—3.00
22	—3.75	34	—2.75
24	—3.50	36	—2.50
26	—3.25	38	—2.00
28	—3.25	40	—1.50
30	—3.25		

of reserve accommodations and the abscissas representing the subjects' ages.

It soon became apparent that a dividing line could be drawn between the plottings for the two groups. This is shown in the graph. A person whose reserve accommodation is less than the amount indicated needs a special correction for close work. The accompanying table presents the data on the relations shown graphically. No differences were found between the sexes. Normally, a younger person

has more reserve accommodative power than an older person. This may be explained by the fact that a person with a more plastic lens requires a smaller contraction of his ciliary muscle during accommodation than does a person with a less plastic lens.

I perform my test in the following way: The subject's usual or proposed correction for distance is placed in the rear cells of the trial frame. Under good illumination, the subject is asked to read Jaeger 1 or Snellen 0.5 type aloud while holding it at exactly 11 inches (28 cm.) from the eyes. Equal minus spheres, usually from —1 to —2 D. in power, selected in inverse relation to the person's age, are simultaneously placed before each eye in the front cells of the trial frame. If the subject is able to continue his reading, the minus spheres are quickly replaced by others ½ D. stronger. Then, after a line or two more has been read, another quick increase of ½ D. is made. This is continued until finally the subject falters in his reading. The dioptric power of the minus spheres that were previously before the eyes—½ D. less than is being worn—indicates the amount of the reserve accommodation.

30 East Fortieth Street.

SUPPOSED TORSION OF THE EYE AROUND THE VISUAL AXIS IN OBLIQUE DIRECTIONS OF GAZE

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MEXICO, D. F., MEXICO

THE ERRORS committed by great men are usually in direct proportion to their greatness. This has happened in the matter to be discussed here. From correct observations they have drawn wrong conclusions. I shall reconstruct this confused chapter in physiologic optics and ocular motility, using, in addition to the experiments of others, those of my own. This work had its origin in some questions about ocular torsion which were put to me by Dr. Joseph I. Pascal at our meeting in Mexico in August 1947. Frankly, I could not answer them satisfactorily, nor did we get much enlightenment when we consulted together the classic works of von Helmholtz,[1] Tscherning,[2] Giraud-Teulon,[3] and Le Conte,[4] the most recent works of Ives Le Grand,[5] and other publications. On parting, I promised Dr. Pascal to get to the bottom of this matter and the results of my investigations are presented in this paper.

The subject concerns facts and interpretations which the authors of books have copied from one another since the first experiments of Ruete[6] (1847). This body of observations was wrongly interpreted by Donders, and afterward by von Helmholtz, who affirmed that the eye undergoes torsional movements around the visual axis in oblique

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Presented before the Third Pan-American Congress of Ophthalmology, Habana, Cuba, Jan. 5, 1948 in condensed English translation.

The condensed translation was made from the Spanish by Dr. Joseph Pascal, to whom this paper is dedicated by the author.

1. Helmholtz, H.: Optique physiologique, translated by E. Javal and N. Klein, Paris, V. Masson & fils, 1887.

2. Tscherning, M.: Optique physiologique: Dioptrique oculaire; fonctions de la rétine; les mouvements oculaires et la vision binoculaire, Paris, G. Carré & C. Naud, 1898.

3. Giraud-Teulon, M. A. L. F.: La vision et ses anomalies, Paris, J.-B. Baillière & fils, 1881.

4. Le Conte, J.: Sight, New York, D. Appleton & Co., 1881.

5. Le Grand, I.: Optique physiologique, Paris, J.-B. Baillière et fils, 1946.

6. Ruete, C. G. T.: Leerbock der opthalmologie: In het Nederduetsch bewerkten met Aanteekeningen voorzien door Dr. Donders, Utrecht, C. van der Post, Jr., 1847.

directions of gaze and that these torsions can be shown by means of "after-images." Giraud-Teulon described it as follows.[7]

> A linear after-image shows, after execution of a movement, the direction of the meridian which retained that linear image. . . . After-images are formed when, after the subject has fixated intensely a point for about twenty seconds, the gaze is turned toward a uniformly gray wall; then, after a few seconds, the after-image appears.

Ruete made these experiments with a bright red ribbon placed horizontally and then vertically, and also with two ribbons placed in the form of a cross, and observed the complementary green after-image. My colleagues and I made these experiments with an intensely luminous

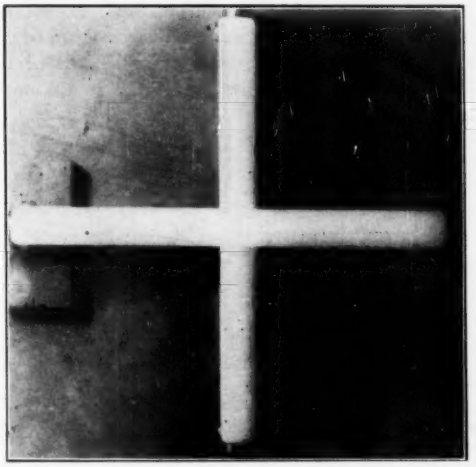

Fig. 1.—Luminous white cross (about one-half size).

white cross (fig. 1), observing a black cross as the after-image. To observe the phenomenon, the cross is placed in front and at the height of one eye or the other or of the two eyes at the same time. The results with each eye are almost always the same, but sometimes they are not, for reasons to be explained later. After the subject has intensely fixated on the center of the luminous cross the arms of which are vertical and horizontal, the light is extinguished and the gaze is turned on a vertical wall (without, however, moving the head), looking directly up or down, to the right or to the left, that is, along the directions of the two arms of the cross. The perpendicularity of the two arms of

7. Giraud-Teulon,[3] p. 649.

the cross in the after-image is preserved. But if the gaze is turned in intermediate directions, oblique to the two arms of the cross, the arms of the after-image no longer appear perpendicular to each other but form two acute angles and two obtuse angles. One acute angle is in the direction of the gaze, and the other acute angle is in the opposite direction; the obtuse angles are between (fig. 2*A*).

If, now, the luminous cross is turned so that its arms are oblique to the vertical and horizontal positions, the perpendicularity of the arms in the after-image remains when the gaze is turned obliquely along one or the other of the arms of the cross. But if the gaze is turned directly up or down, or right or left, the arms of the cross in the after-image are no longer perpendicular to each other but form acute and obtuse angles (fig. 2*B*). From these experiments, it was concluded (fig. 2*A*) that the vertical meridian was tilted in the same direction as the direction of gaze, for example, toward the right if the gaze was directed up and to the right. But it was not taken into

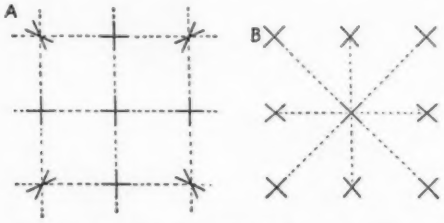

Fig. 2. (from Tscherning [2]).—The obliquity in the diagonal direction of gaze is greatly exaggerated.

account that the horizontal meridian showed exactly the opposite tilt, and that if attention were paid to its inclination the turning of the eye would have to be presented in the opposite direction. It is obvious, then, that both turnings could not take place at the same time if they were torsional movements around an anteroposterior axis of the eye. However, Donders and von Helmholtz interpreted them in this way, with the difference that Donders, concentrating on the supposed inclination of the vertical meridian, said that the inclination was in the same direction as the gaze, whereas von Helmholtz, thinking of the inclination of the horizontal meridian, stated that the torsion was in the opposite direction. This is a contradiction which the second of these illustrious men persistently and politely ignored, while seeking impossible conciliatory explanations. Giraud-Teulon [8] frankly acknowledged the contradictions, himself inclining to the opinion of Donders.

8. Giraud-Teulon,[3] pp. 669 and 672.

None of the three illustrious authors was right. It was Le Conte [9] who said, and Hering [10] agreed with him, that "the diagram [fig. 2*A*] is a correct representation of the phenomena seen in projection on a vertical plane, but it is not a representation of the torsion of the eyes." In order to eliminate the possible error due to the obliquity of the wall on which the image is projected, Le Conte arranged his experiments [9] (experiment 5) so that the after-image could be projected on a plane perpendicular to the visual line, i. e., on the inner surface of a large sphere at the center of which was the eye. In all these cases he found that the arms of the cross in the after-image were perpendicular to each other, though the cross as a whole was tilted in the same direction as the gaze (fig. 3). The tilt was greater, the greater the obliquity of the gaze. Le Conte arrived at the conclusion that the torsion of the eye was only apparent, since the movement was made

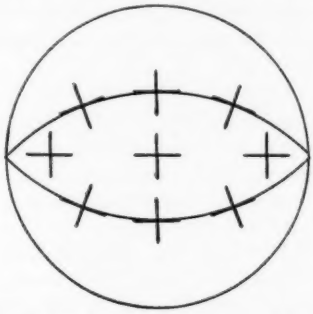

Fig. 3. (Tscherning [2]).—Experiment of Le Conte.

around an oblique axis situated in Listing's plane, or in the equatorial plane of the eye, and not around an anteroposterior axis, which is the characteristic of true torsion. It may be said in passing that true torsional movements do not normally take place for visual purposes and are made only as a compensatory rotation when the head is tilted, as I shall explain later.

Moreover, it is necessary, in discussing the previous experiments, to consider two reasons for the obliquity of the after-images, as pointed out by de Wecker and Landolt [11]: (1) the obliquity of the screen, mentioned before, and (2) a change in the inclination of the meridians of the eye. Although I have already referred to the influence of the

9. Le Conte,[4] p. 189.

10. Hering, E.: Spatial Sense and Movements of the Eye, Baltimore, Williams & Wilkins Company, 1942, p. 128.

11. de Wecker, L., and Landolt, E.: Mouvements des yeux, in Traité complet d'ophthalmologie, Paris, Vve. A. Delahaye et cie, 1885.

obliquity of the screen on which the image is projected, I must supplement this statement. Le Grand [12] wrote:

> . . . the deformation of the cross can be explained by the simple effect of perspective, as a result of which a right angle is not projected as such on a plane unless at least one of its sides is parallel to that plane.

Tscherning [13] stated the same opinion, except that his concept was incomplete. He attributed the obliquity of the horizontal arm "to the projection of the after-image to a plane which was not perpendicular to the visual line," but he did not apply the same reasoning to the inclination of the vertical arm, which is in a similar condition. He limited himself to opposing, and with good reason, the opinion expressed by Donders and von Helmholtz, who attributed the obliquity to a "wheel-like" rotation around the visual line, and he pointed out that "such a rotation could not take place, since the axis in Listing's plane is perpendicular to the visual line." Le Conte [14] expressed the same opinion by saying that "there is merely an apparent rotation around the visual axis."

PRESENT INVESTIGATION

In order to settle this point regarding the perpendicularity or obliquity of the two arms of the cross in the after-image in relation to the obliquity of the screen, I carried out the following experiment: On the surface of the lens of an ordinary flashlight, a cross was drawn surrounded by a circle, and the shadow of this cross was thrown on a wall in a perpendicular direction, imitating that which takes place in the primary position of the eyes. The "shadow" image appeared as a cross with the arms perpendicular to each other, surrounded by a circle.

If, then, with the arms of the cross placed in a vertical and a horizontal position, the light was projected upward or downward along the direction of the vertical limb, the arms of the cross remained vertical and horizontal, but (and this has never been mentioned before) the vertical arm was longer than the horizontal arm and both appeared to be surrounded by an ellipse the major axis of which was vertical. If the light was turned in the direction of the horizontal arm, the ellipse appeared with its major axis horizontal. In either case the more oblique the projection on the wall, the more the ellipse was elongated in the direction of movement of the light. If, then, the light was projected, not along the direction of the arms of the cross, but in the intermediate directions, in addition to the formation of ellipses with the longer

12. Le Grand,[8] p. 172.
13. Tscherning,[2] p. 276.
14. Le Conte,[4] p. 197.

axes in the direction of movement, as in the previous case, there disappeared the perpendicularity of the arms of the cross; the arms then formed acute angles in exactly the same direction and did not coincide with the directions of the axes of the ellipse (fig. 4). Thus is shown the influence of the obliquity of the screen on the obliquity of the two arms of the cross, though in the case in which the light was moved in the direction of the arms of the cross, the perpendicularity of the arms was preserved. On the other hand, when the screen was perpendicular (as in projection on the surface of a sphere from its center), the perpendicularity of the arms of the projected image was preserved even when the cross as a whole was tilted, the two arms of the after-image having been rotated in the same direction as the gaze—toward the right, in the case discussed.

The second reason for the tilting of the arms in the after-image is an effective change in the inclination of the meridians and the axes

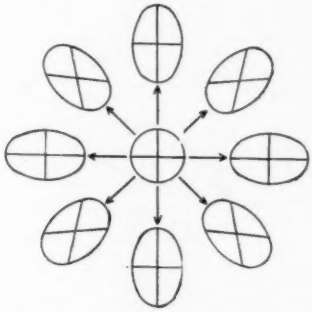

Fig. 4.—Elongation of circle to ellipse and obliquity of arms of cross.

of the eye. I refer now to the vertical and the horizontal; but, as Le Grand [15] pointed out, "one must not attribute to the vertical and horizontal directions special properties, since the law of Listing considers the primary position as an axis of revolution around which no direction is privileged. It is clear that this statement refers only to the mechanism of the ocular movements, since, from another point of view, that is, the division of the retina into two zones by the vertical meridian (the nasal in relation to the crossed fibers of the chiasm and the temporal in relation to the uncrossed fibers) the vertical meridian of the retina has a special significance, as will be shown later. The retinal image of the luminous cross remains always with its arms at right angles, although in certain oblique projections they appear otherwise.

15. Le Grand,[5] p. 173.

In order to understand exactly what occurs with the different axes and meridians of the eye, one may take a sphere on which is drawn a vertical and a horizontal meridian, and on which is also indicated the vertical, horizontal and anteroposterior axes, and on the ends of the anteroposterior axis one may mark two circles, one in the center of the anterior half, to represent the cornea, or the pupil if you wish, and the other at the center of the posterior half, to represent the fovea centralis. One may pierce the sphere with long needles, which project a few centimeters beyond the sphere and which represent the aforementioned axes. At the level of the equator, or Listing's plane, are indicated between the vertical and horizontal axes two oblique intermediate axes. One may pierce the sphere with two needles in order to rotate the globe around the oblique axes in representing oblique directions of the gaze. Such an "eye" is placed between a vertical

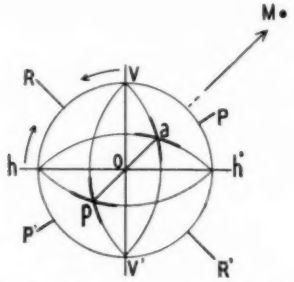

Fig. 5.—Axes of the eye and the vertical and horizontal meridians of the anterior segment (a) and of the posterior segment (p).

wall marked off in squares and the observer, and the experiment is begun.

Suppose one wishes to see what happens when the right eye turns up and to the right. The sphere having been placed so that its horizontal axis coincides with one of the horizontal lines and its vertical axis with one of the vertical lines of the "square," it is rotated around one of the oblique axes, the one which in Listing's plane goes from above and inward, down and outward.

1. First I wish to make a distinction, which I have not seen in any of the treatises, between what takes place with the vertical and horizontal axes of the eye which pass through its center of rotation, and what takes place with the vertical and horizontal meridians on the anterior and on the posterior hemisphere (fig. 5), that is, the retina. The upper extremity of the vertical axis is tilted inward, backward and downward (the lower extremity is tilted outward, forward and upward,

that is, in the opposite direction). In the following discussion, I shall refer only to the upper extremity; when this is turned inward there is intorsion, and when this is turned outward there is extorsion. The horizontal axis is tilted so that its inner extremity is directed forward, upward and outward, its outer extremity turning in the opposite direction. The upper extremity of the vertical axis and the inner extremity of the horizontal axis move apparently in opposite directions (fig. 6), as a result of which, when the sphere is projected on the vertical wall laid out in squares, these come closer together and form an acute angle open upward and inward, or in the direction opposite the side toward which the gaze is directed.

2. On the anterior hemisphere, the vertical and horizontal meridians always make a right angle, and, seen from in front, they are tilted when the eye is turned on an oblique axis in Listing's plane, so that,

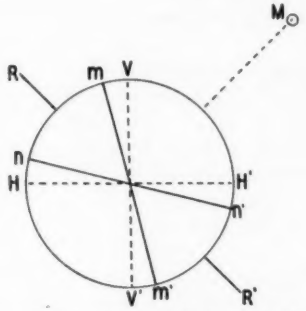

Fig. 6.—Apparent movement of the vertical and horizontal axes of the eye in opposite directions.

in the present example, the upper extremity of the vertical axis is turned inward and the inner extremity of the horizontal axis moves downward, with the result that in both there is an apparent movement of intorsion in a direction opposite the side to which the gaze is directed (fig. *7A*).

3. On the posterior hemisphere, the vertical and horizontal meridians of the retina seen from behind, and always forming a right angle, are tilted so that the upper extremity of the vertical meridian is turned outward and the inner extremity of the horizontal meridian upward, with the result that there is apparent extorsion in the direction of the gaze (fig. *7B*).

It is now apparent (1) that the vertical and horizontal axes move in opposite directions, and (2) that the vertical and horizontal meridians move in the same direction with reference to each other in each

hemisphere and, moreover, that those on the anterior hemisphere move in the direction opposite those on the posterior hemisphere.

Another interesting fact has not previously been mentioned. Whereas in movements around axes in Listing's plane the anterior hemisphere moves in a direction opposite the posterior hemisphere, in rotatory movements around an anteroposterior axis the anterior and posterior hemispheres move in the same direction, so that, for example, the upper vertical radius of the cornea or of the iris moves in the same direction as the upper vertical radius of the retina. It is important that one remember this in order to understand the projection of the after-images.

I insist that the movements produced in oblique directions of gaze are not torsion movements, as Donders and von Helmholtz maintained, but are movements of pseudotorsion. True torsion movements (wheel-like rotations) do not normally take place as movements for visual purposes.

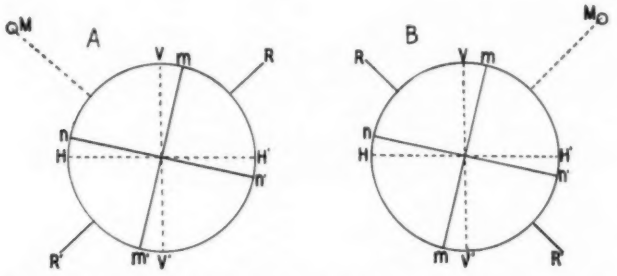

Fig. 7.—*A*, rotation of the meridians of the anterior segment, opposite the direction of gaze. *B*, rotation of the meridians of the posterior hemisphere in the direction of gaze.

Vision, it has been well said, is like touching at distance with the fovea (which is at the ocular end of the visual axis). If the visual line is already in the direction of the point of fixation, torsional movements are unnecessary; and if it is not, torsional movements will not place it there and are therefore useless. However, its usefulness for compensatory movements is undeniable, as will be seen later.

On the other hand, in all movements for visual purposes, whose axes of rotation are in Listing's plane, the fovea, being farthest from the axis of rotation, can be moved with the least muscular force. Movements of this type are produced (1) around a vertical axis—adduction and abduction, in which movements the axis does not change place; (2) around a transverse horizontal axis—elevation and depression, in which the vertical axis moves in an anteroposterior direction, describing a circumference by its upper extremity, and (3) around

oblique axes, perpendicular to the direction of movement. These give rise to the tilting of the vertical and horizontal axes, which were erroneously interpreted as torsions by Donders, von Helmholtz and all those who followed them.

On the other hand, Le Conte,[14] Tscherning,[16] Maddox[17] and Hering[10] did not consider these as torsional movements. It is true that Hering made the error of considering the various inclinations of the vertical and horizontal axes, which are certainly opposite those seen in the projection of the after-images on a vertical wall (i. e., like that in figure 5 and opposite that in figure 2*A*). In order to explain the inclinations as they are really manifest, he was obliged to propose a completely arbitrary hypothesis[18] which it is not worth the trouble to reproduce or to oppose, notwithstanding my admiration for the eminent German master. Starting from a false premise, Hering confused the inclination of the axes, to which he referred and which have nothing to do with the obliquity of the after-image, with those of the meridians of the retina, which are really responsible for the obliquity of the image.

My views on ocular motility throughout my work on the subject[19] have always been opposed to the existence of true torsion, because, while it is certain that in such a movement the vertical axis is tilted inward or outward, the opposite is not true, since in every movement which does not take place around the vertical axis the axis must be tilted, without this showing that there was any torsion. I designate these inclinations produced on oblique direction of the gaze as pseudo-torsion.

Nevertheless, I must add two points: 1. The inclination of the after-images is usually slight (it has already been noted that the inclination has been much exaggerated in the figures (fig. 2*A* and *B*), and (2) the inclination varies with different observers and even at times in the two eyes of the same observer, and it may be zero in some cases. These variations are due to the existence in about 25 per cent of cases to a cyclophoria (ex-cyclophoria or in-cyclophoria), according to Savage (cited by Maddox[20]). This can produce a variation in the inclination of the after-image, increasing or decreasing it.

16. Tscherning,[2] p. 272.

17. Maddox, E.: Tests and Studies of the Ocular Muscles, Philadelphia, P. Blakiston's Son & Co., 1907, pp. 43-45.

18. Hering,[10] p. 124, fig. 46.

19. Márquez, M.: (*a*) Un nuevo esquema didáctico sobre la acción de los músculos oculares extrinsecos, Rev. de med. y cirug. práct. **76**:49-60, 1907; (*b*) Lecciones de oftalmologia clinica, Madrid, 1914, vol. 2, p. 345; (*c*) Lecciones de oftalmologia clinica especial, Madrid, 1936, p. 241.

20. Maddox,[17] p. 236.

The influence of false torsion on the inclination of the image is exactly opposite that of true torsion (cyclophoria). In cyclophoria and in cyclotropia the false image is projected in a direction opposite the rotation of the eye, as is true of the false image in all cases of muscular imbalance. In false torsion the true image, on being projected as an after-image, is inclined in the same direction as the rotation of the eye, since it is the result of the first impression on the meridians of the fovea.

The reason for the inclination of the after-image will be readily understood from figure 8, in which I shall prove that, in addition to the fovea being displaced in this case downward and to the left, its vertical and horizontal meridians have been tilted in the same direction as that of gaze. This does not conflict with the observation that the projected image is inverted up and down and to the right and the left with reference to the retinal image. This explanation in terms of geometric optics, which, incidentally, coincides with that of Dr. Joseph Pascal (personal communication), is completely satisfactory, something which cannot be said of the explanation (in terms of physiologic optics) of Hering or, finally, that of pathologic optics, in which this case of the obliquity of the retinal meridians is compared with what occurs in cyclophoria. I have already indicated the differences between the false image in cyclophoria and the true after-image, and the variability in the inclination of the after-image due to the interplay of these two factors.

In reality, these movements of pseudotorsion are slight and result from the fact that the vertical meridian in not turning around an anteroposterior axis of rotation must necessarily be inclined when the eye turns around an oblique axis.

On the other hand, there is a natural tendency in the eye to maintain the verticality of the vertical meridian. As a result, there are compensatory rotatory movements of the eyes when the head is inclined to either shoulder, as was pointed out by Nagel and others. When the eye looks up and to the right, the muscles involved are the superior rectus and the right inferior oblique, which in extreme abduction has completely lost its elevating action (according to the calculations of van der Hoeve [21]), but its two other actions are at a maximum, i. e., the abduction which is added to that of the external rectus and the extorsion. This would produce a marked extorsion did not the superior oblique come into play in order to prevent the vertical meridian from losing its verticality. This muscle has no depressing effect on the eye in abduction, but it has an abduction effect, which is

21. van der Hoeve, J.: Ueber Augenmuskelnwirkung und Schielen, Klin. Monatsbl. f. Augenh. **68**:492, 1922; Ocular Movements, Bowman Lecture (1932), Tr. Ophth. Soc. U. Kingdom **52**:1-31, 1932.

added to that of the external rectus, as in the case of the inferior oblique, and an intorsion effect which is considerably increased in looking up and out, according to the calculations made on my (muscle) scheme by Dr. Rivas Cherif,[22] which action would oppose extorsion of the vertical meridian.

I stated in 1907 [19a] that the so-called torsion movements of the eyes on tilting the head to either shoulder, which according to Tscherning cannot be fully compensatory, since they do not exceed 6 or 7 degrees, are made for the purpose of having the impressions from the right side always fall on the two left halves, and those from the left side fall on the two right halves, of the retinas. Without these small

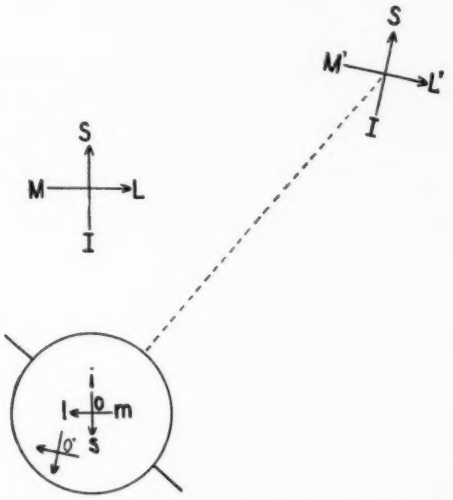

Fig. 8.—Explanation of the formation of the after-image in an oblique direction of gaze (Márquez).

compensatory movements, the inclination of the head to one side or the other would result in the impression sometimes being transmitted by the uncrossed fiber bundle and at other times by the crossed fiber bundle of the chiasm. This would produce the greatest confusion in the visual centers. This observation of mine, which passed unnoticed, was revived in 1927 (twenty years later) by Tschermak,[23] who stated

22. Rivas Cherif: Oral communication to the author, 1946.

23. Tschermak, A.: Ueber die funktionelle Bedeutung der Sechszal der Muskeln des Auges, Ber. ü. d. Versamml. d. deutsch. ophth. Gesellsch. **46**:5-14, 1927.

the opinion that these movements "were made in order to maintain the exact sensorial correspondence of the two retinas."

The fundamental error in the interpretation of the after-images in oblique directions of gaze has been twofold: on the one hand, that of attributing the inclination of these images to a torsion of the eye around the visual line, instead of to a pseudotorsion on an oblique axis in Listing's plane and, on the other hand, that of confusing the axes of the eye which pass through the center of rotation, and which play no part in these phenomena, with the vertical and horizontal meridians of the retina which pass through the center of the fovea, whose inclination in the same direction as that of the gaze determines the obliquity of the after-image by a mechanism purely of geometric optics.

SUMMARY

The experiment of Ruete about the middle of the last century showed that the after-image of a bright cross with vertical and horizontal arms when projected obliquely on a vertical wall lost the perpendicularity of its arms, which were then inclined at an acute angle. This observation was erroneously interpreted by Donders and by von Helmholtz as due to a movement of torsion or of rotation around the visual axis.

I consider this interpretation unfounded and have shown in various publications since 1907 that, whereas in cases of torsion of the eye the vertical axis is inclined toward one side or the other, the opposite is not necessarily true, since it can be inclined in other types of movement, namely, in rotations on an oblique axis in Listing's plane, such as happens in pseudorotation.

I have shown by means of new experiments the mechanism which produces the obliquity of the after-image. Le Conte showed that when the screen of projection is perpendicular to the line of gaze the arms of the cross remain perpendicular to each other, although the cross as a whole is tilted in the direction of the gaze. I have shown that this tilt has been much exaggerated by previous authors, that it varies from one observer to another and even for the two eyes of the same observer, and that it may be zero. One cause of error is the frequent occurrence of cyclophoria of a greater or less extent, which distorts the results of the experiment.

A study of the ocular movement shows the influence which they exert not only on the axes of the eye but also on the vertical and horizontal meridians at the anterior and posterior poles of the eye. A study of the meridians at the fovea and their inclination in the same direction as the direction of gaze explains the obliquity of the after-image. As an example of the muscles involved in any oblique movement, one may take that of looking up and to the right. The superior rectus is the maximum elevator muscle; the inferior oblique in abduc-

tion has practically no elevating effect but has a strong abduction and extorsion effect, the extorting effect being neutralized by the intorting effect of the superior oblique muscle.

I have shown that normally there are no torsion movements for the purpose of aiding vision and that those movements which appear as torsion are in reality pseudotorsions produced by rotation around an oblique axis in Listing's plane. Real torsional movements would be unnecessary if the visual axis was directed to the point of fixation and would be useless if the visual axis was not so directed, as such movements cannot place the eye in the proper direction.

There exist slight torsion movements which Tscherning estimated at a maximum of 6 to 7 degrees. These have nothing to do with the pseudotorsion produced in oblique directions of gaze. These slight torsion movements are for the purpose (Márquez,[10a] Tschermak [23]) of preserving the verticality of the vertical meridian of the retina in order to avoid the confusion which would result in the visual centers if visual impressions were sometimes transmitted by the nasal half of the retina and the crossed fibers of the chiasm and at other times by the temporal half of the retina and the uncrossed fibers of the chiasm.

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NEUROFIBROMATOSIS ASSOCIATED WITH TUMORS OF THE OPTIC PAPILLA

Report of a Case

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A NEUROFIBROMATOUS growth of the optic papilla is indeed rare. Up to the present, only 1 such case has been recorded in the literature (Stallard [1]). It is the purpose of this paper to report another case, in which both optic disks were similarly involved. The patient also manifested numerous other abnormalities which are associated with neurofibromatosis (von Recklinghausen's disease).

REPORT OF CASE

History.—A white man aged 26, private first class in the Army of the United States, was admitted to a regional station hospital on Oct. 6, 1945, because of abdominal pain. There was a history of symptoms of duodenal ulcer for four or five years. A roentgenologic series of the gastrointestinal tract clearly showed a deformity of the duodenal cap. The patient was placed under strict dietary control, with complete relief from his annoying epigastric complaints.

It was also established at the time of his admission that for nine years he had had gradual loss of hearing, which audiometric and other hearing tests showed to be 54 per cent. He had had the usual diseases of childhood except scarlet fever and diphtheria. His mother, father and one brother were alive and well. There was no history of hereditary familial disease.

Examination of the anterior surface of the left forearm revealed a tumor of moderate size which was freely movable and was unattached to the underlying structures. The rest of the physical examination was incomplete.

On Dec. 19, 1945 the patient was transferred to the Borden General Hospital for a hearing aid. A surgical consultant diagnosed the tumor of the left forearm as a lipoma and advised its removal. On Jan. 19, 1946 the tumor was excised (fig. 1); it was found to be intimately attached to the ulnar nerve. The pathologic diagnosis, made on January 29, was perineurial fibroblastoma.

The question of mental deficiency was raised, since the patient had completed only the third grade in grammar school. This suspicion was confirmed by the Wechsler-Bellevue tests, which demonstrated an intelligence quotient of 74. The brother was also mentally deficient. On March 24, the patient was transferred to Moore General Hospital.

Presented at a meeting of the New York Academy of Medicine, Section of Ophthalmology, April 19, 1948.

1. Stallard, H. B.: A Case of Intraocular Neuroma (von Recklinghausen's Disease) of the Left Optic Nerve Head, Brit. J. Ophth. **22**:11, 1938.

Physical Examination.—The patient was fairly well developed but poorly nourished. Inspection of his back revealed many soft, doughy masses along the course of the intercostal nerves (fig. 2). There were several small, soft mollusca fibrosa on the anterior abdominal wall. A number of café au lait patches were scattered over the trunk and thighs. Along the inner aspect of the

Fig. 1.—Excision of a neurofibroma involving the left ulnar nerve.

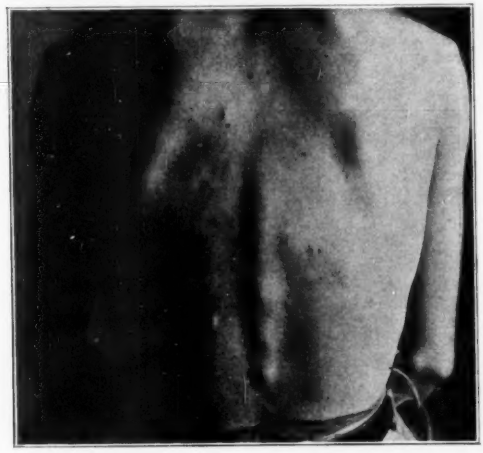

Fig. 2.—Neurofibromas along the course of the intercostal nerves on the posterior part of the body.

left arm distinct, soft masses ranging from 0.5 to 1.5 cm. in length (fig. 3), could be palpated. The blood pressure was 124 systolic and 72 diastolic. The liver and spleen were not palpable.

On March 26, red blood cells numbered 4,490,000, with 99 per cent hemoglobin. The white cell count was 6,150, with 58 per cent polymorphonuclear neutrophils, 36 per cent lymphocytes, 4 per cent monocytes and 2 per cent basophils. The Kahn reaction was negative. On April 25, the sedimentation rate

Fig. 3.—Inner aspect of the left arm revealing the small neurinomas of the cutaneous nerves.

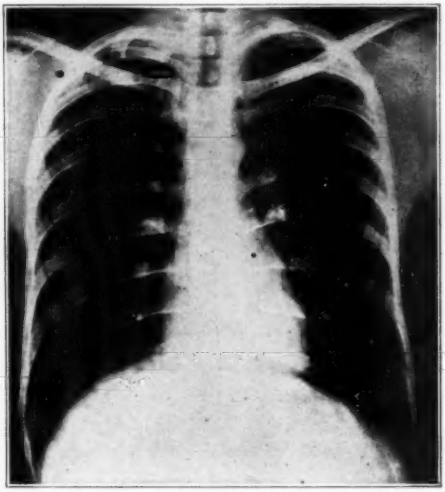

Fig. 4.—Roentgenogram demonstrating a homogeneous, circumscribed mass in the apex of the right lung.

was 18 mm. in one hour, and the hematocrit reading was 45. The urine gave a negative reaction for albumin and sugar, but microscopic examination revealed the presence of a few pus cells. Lumbar puncture on April 27 showed that the spinal fluid was normal and under normal pressure.

A roentgenogram, taken on April 25, demonstrated a round, homogeneous, soft extrapleural shadow extending into the apex of the right lung (fig. 4). The mass measured 3 by 4 cm. and was directed downward. The shadow had no connection with the ribs or other bony structures. Roentgenographic studies of the skull on this date showed no alteration from the normal. It was suggested that another specimen be taken for biopsy.

On May 17, a small, doughy mass was removed from the patient's back. Pathologic examination (Major B. Bornstein, chief of laboratory) was reported on May 27, as follows: The mass was soft, rubbery and ovoid, measuring 24 by 12 mm. The surface was smooth and covered on one side by a thin membrane. On cross section the mass was white and showed sago-like granulation. Microscopic examination revealed that the mass was composed of fibers arranged in broad strands and whorls, which contained long, spindle-shaped nuclei, the nuclei in places assuming a palisade appearance (fig. 5). The tumor was surrounded and traversed by strands of loose, collagenous connective tissue. Only a few small capillaries were seen in the connective tissue. The diagnosis was neurofibroma.

Ophthalmologic Consultation (May 4).—Vision was 20/200 in the right eye and 20/20 in the left eye, unimproved by correction. Refraction gave the following values: right eye: + 0.50 D. sph. ⌒ + 0.50 D. cyl., ax. 180; left eye: + 0.50 D. sph. ⌒ + 0.25 D. cyl., ax. 90. Movements of the extraocular muscles were full in all cardinal directions. Digital palpation showed that the intraocular pressure was within normal limits. There were no lesions of the eyelids or the conjunctiva. No ptosis or exophthalmos was noted. The right pupil was larger than the left and reacted sluggishly to light but well in accommodation. Horner's syndrome was not present. The cornea, lens and vitreous were clear.

Fundi: Right eye: A growth of newly formed tissue projected forward from the disk. Its surface was striated but appeared nodular in several areas. The disk was elevated 4 D. nasally and 5 D. temporally (fig. 6). The nasal half was a dull grayish red. No hemorrhages or exudates were visible on the summit or within the circumpapillary space of the elevated disk. The temporal half of the disk was whitish gray and was thrown into vertical corrugations, which proceeded superiorly 3 disk diameters and inferiorly 4 disk diameters, tapering into well defined striations in both directions. Each extremity assumed a forked appearance. The temporal sector of the disk simulated the color scheme seen on the nasal side. The new growth on the disk masked the appearance of the emerging vessels. The superior and inferior nasal veins were the only vessels visible on the summit of the tumor. The temporal vessels were first clearly seen at a distance of about 1 disk diameter from the raised papilla. The veins were full and nontortuous and did not present arteriovenous nicking. The retinal arteries gave an increased central light reflex and appeared somewhat attenuated, so that the ratio of arteries to veins was 1:2. Immediately superior and inferior to the disk, the fundus took on a tigroid appearance. A circumscribed, grayish white patch, measuring ½ disk diameter, was observed in the macular region, two pigment spots being located within its center. A similar, but smaller, patch was located in the inferior temporal quadrant. A small,

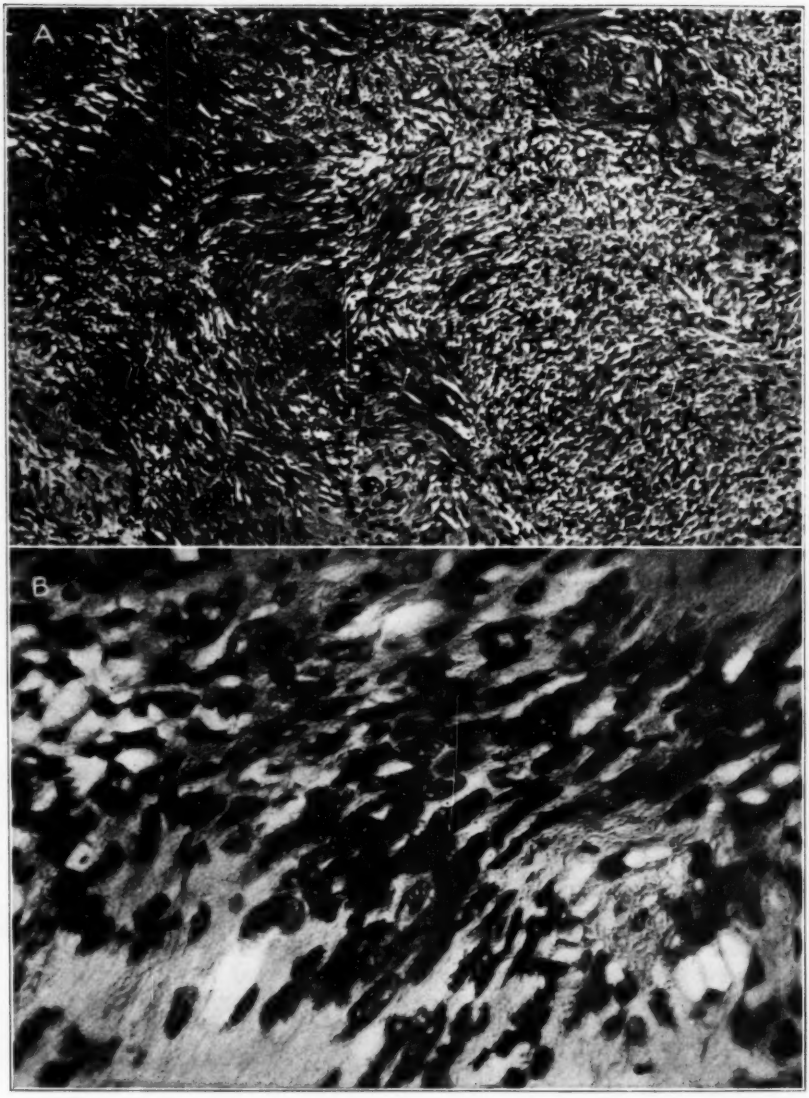

Fig. 5.—*A*, low power magnification of peripheral neurofibroma, showing the typical patternless arrangement of the connective tissue. *B*, high power magnification of the section in *A*, illustrating palisading of nuclei in a perineurial fibroblastoma.

yellowish, highly refractile body was observed below the macula and was in close relation to a fine terminal vein. In the 8 o'clock meridian, about 4 disk diameters away, was a collection of discrete, yellowish flecks. They varied in size and shape, the majority appearing oval. The rest of the periphery was within normal limits.

Fig. 6.—Fundus of the right eye, showing tumor of optic nerve head with retinal fiber medullation, central chorioretinitis and segmental choroidal sclerosis.

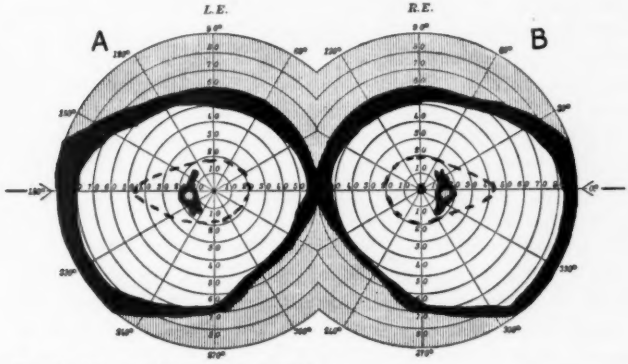

Fig. 7.—Visual fields on May 5, 1946.

A (left eye), enlargement of the blindspot, but smaller than that in the right eye (*B*), no central scotoma; vision 20/20 without correction. Fields were taken with 2 mm. white and 5 mm. red targets at 330 mm.; broken line shows field field for red.

B (right eye), double comma enlargement of the blindspot with forking of extremities corresponding to medullation of the optic nerve; absolute central scotomas for red and white; vision 20/200, uncorrectible. Fields were taken with 2 mm. white and 5 mm. red targets at 330 mm.; broken line shows field for red.

Left eye: The fundus of the left eye closely resembled that of the right eye. The disk, which was elevated 3 D., had the same color pattern as that of the right eye. No pathologic change was noted in the macula. Several small, grayish white patches, with pigment, were scattered in the superior nasal quadrant. Yellowish flecks were also present in the inferior nasal quadrant. No cholesterol crystals were apparent.

Perimetric studies (May 5): The blindspots were enlarged (fig. 7), the right blindspot being slightly larger than the left. A small, absolute central scotoma was demonstrated in the right eye; no central scotoma was observed in the left eye. The peripheral fields were normal.

Diagnoses.—(1) The diagnoses were neurofibroma of the optic papilla, bilaterally associated with medullated nerve fibers and choroidal sclerosis; (2) incipient sclerosis of the retinal arterioles, without hypertension, and (3) central chorioretinitis of the right eye.

Subsequent Course.—The patient was observed until June 1, 1946, when he showed no obvious alterations in his physical or ophthalmic status. On June 5, 1946 I received my discharge from the Army and therefore was unable to continue my observation and study of the patient.

COMMENT

In 1882, von Recklinghausen described a disease characterized by the classic signs of tumors of the skin and the peripheral nerves with cutaneous pigmentation (café au lait patches). The growths, which were referred to as neurofibromas, were present in and beneath the skin and involved various parts of the body. Since the nerve tissue in any part of the organism may become involved in this disease, the picture is often bizarre. Neurofibromatosis is congenital. The disease shows a hereditary disposition, since it occurs irregularly through several generations: Abortive and monosymptomatic forms have been mentioned. In other cases reported in the literature, skeletal involvement,[2] pyschic disorders, intracranial lesions, lesions of the cranial and spinal nerves, disturbances of the glands of internal secretion and hepatomegaly and splenomegaly[3] have been described: The first manifestation may occur at birth or in early life. The tumors are small and usually increase in size slowly, their growth showing a parallelism with the normal growth of the body. Often at puberty the growth of the tumors becomes accelerated, producing symptoms.

When the ocular structures and their adnexa are involved in neurofibromatosis, the parts attacked, in the order of frequency, are the eyelids and the optic nerve; the orbit; the retina; the uvea (iris,

2. Copeland, M. M.; Craver, L. F., and Reese, A. B.: Neurofibromatosis with Ocular Changes and Involvement of the Thoracic Spine: Report of a Case, Arch. Surg. **29**:108 (July) 1934.

3. Billow, B. W.: Von Recklinghausen's Neurofibromatosis; A Case of Hepatomegaly and Splenomegaly, Am. J. Surg. **61**:128, 1943.

choroid and, rarely, the ciliary body); the cornea; the tarsal conjunctiva, and, lastly, the bulbar conjunctiva.

The presence of primary tumors of the optic nerve in association with neurofibromatosis has reecntly received a great deal of attention in the literature (Davis,[4] Gomes[5]). There has been considerable controversy among pathologists concerning the nature of the tumors which accompany the disease, since the cause of neurofibromatosis and related lesions is still unknown. Many authors have asserted that the finding of a tumor of the optic nerve in the presence of neurofibromatosis is merely coincidental and should not be considered a manifestation of the same syndrome. Other workers, among whom are Emanuel[6] and Davis,[4] stated the opinion that the so-called primary tumors of the optic nerve are in many instances only a part of this syndrome.

Del Río-Hortega[7] offered an interesting theory of a common source of origin of tumors of the optic nerve and tumors of the peripheral nerves. He asserted that the oligodendroglia of the optic nerve is homologous with the Schwann cells of the peripheral nerves; since the two cellular elements maintain the myelin sheath of the nerve, he suggested that these homologous structures, although differing greatly in their anatomic architecture, could be affected simultaneously by a common cause.

Verhoeff,[8] in 1932, stated that in a possible 4 cases "a glioma of the optic nerve was associated with von Recklinghausen's disease." He added, however, that "it does not follow that the tumor of the optic nerve is related to fibroma of the peripheral nerves, except to the extent that both may be dependent upon some congenital developmental anomaly."

The growths in the optic nerve heads in the present case resembled the picture described by Stallard, with several minor exceptions. The nasal halves of the elevated disks had a grayish red coloration. This hyperemic tinge was probably due to the presence of newly formed capillaries, intermingled with the new growth. Verhoeff found that some

4. Davis, A. F.: Primary Tumors of Optic Nerve, Tr. Sect. Ophth., A. M. A., 1939, p. 145.

5. Gomes, J. P.: Tumors of the Optic Nerve, Am. J. Ophth. **24**:1144, 1941.

6. Emanuel, C.: Ueber die Beziehungen der Sehnervengeschwülste zur Elephantiasis neuromatodes und über Sehnervengliome, Arch. f. Ophth. **53**:129, 1902.

7. del Río-Hortega, P.: Tercera apartación al conocimiento monfológico e anterpretación functional de la oligodendroglia, Mem. Soc. espãn. de hist. nat. **14**:5, 1928.

8. Verhoeff, F. H.: Tumors of the Optic Nerve, in Penfield, W.: Cytology and Cellular Pathology of the Nervous System, New York, Paul B. Hoeber, Inc., 1932, vol. 3, p. 1029.

neurofibromatous tumors tend to become vascularized in time. I do not believe that this angiomatous feature is unusual, since the phakomatoses are closely related (Moolten [9]), and it is not surprising to observe occasional mixed forms. It has been shown that there are numerous points of resemblance between the tuberous sclerosis complex and von Recklinghausen's multiple neurofibromatosis. The lesions are regarded as hamartomas, and not true neoplasms.

In the present case, the temporal halves of the elevated growths showed moderately thickened and well delineated, medullated nerve fibers. The terminal striations presented thickened, individual nerves and appeared decidedly wider than the usual fine, feathery striations which one often observes in the classic picture of the fundus. Reese and associates [2] described the presence of medullated nerve fibers in both eyes of a patient with neurofibromatosis. Fischer [10] found medullated nerve fibers in the retinas of 4 of 12 patients with generalized neurofibromatosis. He was inclined to believe that the incidence of medullated nerve fibers in the retina was greater among patients with definite abnormalities of the central nervous system or with psychopathic disturbances. This view has been substantiated in several cases and is readily applicable to the present case, since mental retardation was demonstrated conclusively by the Bellevue-Wechsler tests. Manz [11] found retinal medullation in 4 of 130 inmates of an asylum. On the other hand, he performed a routine ophthalmic examination of 3,250 patients and uncovered only 1 case of medullated nerve fibers in the retina.

The yellowish flecks seen in the fundi closely resembled those described by Stallard. The attenuation and the increase in the central light reflexes of the retinal arteries, the cholesterol crystals and the early choroidal sclerosis favored the additional diagnosis of early retinal arteriosclerosis. The small, chorioretinitic patches were presumably old, healed degenerative lesions, a picture not infrequently seen with the phakomatoses. There were no lesions in the retina which resembled tuberous sclerosis.

Stallard described a hemispherical mass projecting from the disk. It was grayish, with a nodular surface. Its outline and edges were ill defined. Some small, irregular flecks were present in the retina, adjacent to the disk. Histologic sections demonstrated irregular-shaped clumps and sweeping bundles of neurocytes, neurofibrils and many small cysts. The microscopic picture was characteristic of a

9. Moolten, S. E.: Hamartial Nature of the Tuberous Sclerosis Complex and Its Bearing on the Tumor Problem, Arch. Int. Med. **69**:589 (April) 1942.

10. Fischer, H.: Beitrag zur Recklinghausenschen Krankheit: Missbildungen am Auge, besonders die markhaltigen Nervenfasern der Netzhaut, Dermat. Ztschr. **42**:143, 1924.

11. Manz, cited by Fischer.[10]

neurofibroma. The projecting mass was wedged laterally, involving all the layers of the retina. Reese referred to the alterations in the optic nerve in Wheeler's case [12] as neurofibromatous. Since microscopic studies in my own case were impossible, it is difficult to state from the clinical findings whether the condition was a true neurofibromatous tumor of the optic nerve or a type of gliomatous growth, as described by Davis.[4]

Cases of papilledema were reported by Stern,[13] Lisch [14] and Schmidt.[15] Wiegmann,[16] Fuchs [17] and Holmström [18] described optic nerve atrophy in association with neurofibromatosis. The atrophy was either the result of a simple descending type of degeneration or was postneuritic. The normal spinal fluid and normal pressure, the normal roentgenograms of the skull and the absence of progressive or receding changes in the elevated disks in my case were against the diagnosis of papilledema. Roentgenograms of the optic foramens were not taken.

Goldstein and Wexler [19] described a case of neurofibromatosis in which melanosis of the uveal tract and melanomas of the iris were the outstanding ocular lesions. In addition, the patient had a fibrosarcoma and a distinct endocrinal dysfunction. Again, in 1932, the same authors [20] described a case in which a spongioneuroblastoma of the left optic nerve was associated with the diffuse neurofibromatosis of von Recklinghausen.

It is interesting to note that buphthalmos is not infrequently associated with neurofibromatosis. The buphthalmic condition is attributed by some authors to a congenital defect in the filtration angle and mal-

12. Wheeler, J. M.: Plexiform Neurofibromatosis (von Recklinghausen's Disease) Involving the Choroid, Ciliary Body and Other Structures, Tr. Am. Ophth. Soc. **34**:151, 1936.

13. Stern, R. O.: Tumor of Optic Nerve, Chiasm, and Thalamus, Proc. Roy. Soc. Med. **30**:1096, 1937.

14. Lisch, K.: Ueber Beteiligung der Augen bei der Neurofibromatosis (Recklinghausen), Ztschr. f. Augenh. **93**:137, 1937.

15. Schmidt: Multiple Neurinome mit Beteiligung der Papillen, Klin. Monatsbl. f. Augenh. **101**:115, 1938.

16. Wiegmann: Ein Fall von Recklinghausenscher Krankheit mit Komplikationen seiten der Augen, Klin. Monatsbl. f. Augenh. **68**:395, 1923.

17. Fuchs, A.: Ueber einfache Opticusatrophie bei Recklinghausenscher Erkrankung, Wien. klin. Wchnschr. **50**:291, 1937.

18. Holmström, M.: Zwei Fälle von Exophthalmos bei Neurofibromatosis Recklinghausen, Acta. ophth. **6**:403, 1928.

19. Goldstein, I., and Wexler, D.: Melanosis Uveae and Melanoma of the Iris in Neurofibromatosis, Arch. Ophth. **3**:288 (March) 1930.

20. Goldstein, I., and Wexler, D.: Spongioneuroblastoma in Neurofibromatosis (Recklinghausen), Arch. Ophth. **7**:259 (Feb.) 1932.

development of the spaces of Fontana. The iris is usually adherent by broad synechias to the posterior margin of the cornea.

In the first biopsy of peripheral nerve in the present case, the diagnosis was perineurial fibroblastoma. In another biopsy of nerve, on May 27, 1946, the microscopic diagnosis was neurofibroma. This discrepancy is understandable in view of the frequent observation of perineurial fibroblastic growths in the center of neurofibromas, as Penfield [21] and others have shown. The connective tissue in a neurofibroma of a peripheral nerve shows a characteristic patternless arrangement. The nuclei are not arranged in any particular order. A great deal of variation in the microscopic appearance of these tumors is likely to be present. The presence of nerve fibers within the tumor may be considered pathognomonic of neurofibroma. The appearance of the tumor in general is like a reaction about nerve fibers, rather than a neoplastic growth. Neurofibromas are benign and do not metastasize. They usually involve the peripheral nerves. The outstanding histologic characteristic of perineurial fibroblastomas is the nature of the collagen fibers. They are long and of even caliber and tend to be parallel. The neuclei are arranged in long rows and frequently give the appearance of Verocay's palisades. These tumors are neoplastic and are usually present in nerve roots.

The gradual diminution of hearing in my case over a period of nine years, in association with the widespread multiple manifestation of neurofibromatosis, strongly favors the diagnosis of bilateral acoustic neuroma. Frazier and Gardner [22] reported on a remarkable family in which numerous members had bilateral deafness. Later studies revealed bilateral acoustic neurofibromas in these persons. Steurer [23] reported 2 cases of neurofibromatosis in which the acoustic nerves were involved. In Katzenstein's [24] case there was similar infiltration of the acoustic nerve. Shapland and Greenfield [25] reported a case of bilateral deafness, due to tumors in the cerebellopontile angles.

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21. Penfield, W.: Cytology and Cellular Pathology of the Nervous System, New York, Paul B. Hoeber, Inc., 1932, vol. 3, p. 967.

22. Frazier, C. H., and Gardner, W. J.: Bilateral Acoustic Neurofibromas: Clinical Study and Field Survey of a Family of Five Generations with Bilateral Deafness in Thirty-Eight Members, Tr. Am. Neurol. A. **55**:187, 1929.

23. Steurer, O.: Ueber Beteiligung des inneren Ohres und des Hörnerven bei multipler Neurofibromatosis, Recklinghausen, Ztschr. f. Hals-, Nasen-u. Ohrenh. **4**:130, 1922.

24. Katzenstein, R.: Ueber innere Recklinghausensche Krankheit (Endotheliome, Neurinome, Gliome, Gliose, Hydromyelic), Virchows Arch. f. path. Anat. **286**:42, 1932.

25. Shapland, C. D., and Greenfield, J. G.: Neurofibromatosis with Meningeal Tumor Involving the Left Optic Nerve, Tr. Ophth. Soc. U. Kingdom **55**:257, 1935.

Again, the round, homogeneous, extrapleural mass in the apex of the right lung shown in the roentgenogram was probably a benign tumor. Originally, the possibility of a tumor of the superior pulmonary sulcus was entertained but was discarded, since the characteristic clinical and roentgenographic signs were wanting. In the differential diagnosis, one must also consider the possibility of a primary, apical carcinoma or a sarcomatous infiltration of the ribs. In repeated roentgenologic studies, no demonstrable alterations were found in the apex of the right lung or in the neighboring tissues. A biopsy specimen was not taken, but, because of the benign character of the growth, and the widespread, multiple involvement in this unusual case, a diagnosis of neurofibroma was made. It was suggested that the tumor might have arisen from one of the cords of the brachial plexus.

Davis advised that in all cases of tumor of the optic nerve a systematic investigation be made for all the signs of neurofibromatosis—specifically, soft nodules of the skin; café au lait spots; possible lesions of the choroid, ciliary body and iris in association with buphthalmos; skeletal deformities, and neurofibromatosis, especially of the eyelids and the orbital nerves. On the other hand, I suggest that in all cases of neurofibromatosis a thorough examination be made of the eyes, including roentgenograms of the skull and optic foramens, exophthalmometric readings and air studies of the orbital spaces.

SUMMARY

A case of bilateral tumor of the optic nerve, involving the papilla, associated with neurofibromatosis is reported. Unusual associated findings were (*a*) a neurofibromatous growth in the apex of the right lung, (*b*) bilateral acoustic neuroma, (*c*) mental retardation and (*d*) medullation of the retinal nerve fibers.

Neurofibromatosis is briefly dicussed with respect to its etiology, incidence, pathology, clinical manifestations, diagnosis and differential diagnosis.

Other ocular lesions associated with neurofibromatosis are described.

The relation of primary tumors of the optic nerve to neurofibromatosis, as discussed by Davis, is briefly reviewed.

It is suggested that all patients with neurofibromatosis be subjected to a complete, and most critical, ophthalmologic examination.

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CONTACT LENS ELECTRODE FOR IONTOPHORESIS

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EXPERIENCE with iontophoresis goes back to the end of the last century. In recent years, sodium sulfathiazole [1] and a number of other substances [2] have been recommended as therapeutic agents. The procedure, however, has been much more widely discussed since the introduction of penicillin [3] led to spectacular results.

The electrodes used in iontophoresis range from a medicated piece of cotton, placed between a small metal plate and the eye, to a cylindric glass tube, adapted to fit the shape of the cornea. Sometimes a plain probe is employed, such as Hamberger's electrode, consisting of a piece of cotton, which has been saturated with the medicinal solution, wrapped around the end of a thin carbon rod.[4]

All these types of electrodes must be held in position by the operator throughout the treatment, since they are not so devised that they will stay in place unsupported. Furthermore, they are difficult to manipulate and are apt to cause injury to the epithelium of the cornea, even when handled with care. By reason of these defects of iontophoresis, Duncan [5] suggested application of penicillin by means of a corneal bath. Selinger,[6] however, succeeded in devising a greatly improved electrode. The instrument is essentially a contact lens base with a narrow chimney extending from its center. But the new instrument appears to have

1. Boyd, J. L.: Sodium Sulfathiazole Iontophoresis, Arch. Ophth. **28**:205-213 (Aug.) 1942.

2. Fleming, N.: Iontherapy (Ionic Medication, Iontophoresis, Ionisation) as an Aid in Ophthalmic Therapeutics, Brit. J. Ophth. **27**:354-367 (Aug.) 1943.

3. von Sallmann, L., and Meyer, K.: Penetration of Penicillin into the Eye, Arch. Ophth. **31**:1-7 (Jan.) 1944. Dunnington, J. H., and von Sallmann, L.: Penicillin Therapy in Ophthalmology, ibid. **32**:353-361 (Nov.) 1944. Wright, R. E., and Stuart-Harris, C. H.: Penetration of Penicillin into the Eye, Brit. J. Ophth. **29**:428-436 (Aug.) 1945. von Sallmann, L.: Penetration of Penicillin into the Eye, Arch. Ophth. **34**:195-201 (Sept.) 1945.

4. Klein, M., in Ridley, F., and Sorsby, A.: Modern Trends in Ophthalmology, New York, Paul B. Hoeber, Inc., 1940, p. 510.

5. Duncan, H. A. G.: Plastic Corneal Bath for Application of Penicillin, Arch. Ophth. **33**:3-314 (April) 1945.

6. Selinger, E.: Office Treatment of the Eye, Chicago, The Year Book Publishers, Inc., 1947, p. 519.

two imperfections: At times the electrode has to be steadied during the treatment; furthermore, as the chimney containing the solution is open at the top, the liquid tends to escape around the base.

An improved contact lens electrode would, therefore, have to incorporate modifications to meet the following criteria: 1. The possibility of injury to the cornea must be completely excluded by an arrangement which effectively keeps the electrode from touching the tunic of the eye, and permits only the medicament to come in direct contact with the cornea. 2. The instrument must be constructed in such a manner that, once installed, it would stay in place without requiring further support by

Fig. 1.—Lateral view of contact lens electrode. A platinum electrode is accommodated between two contact lenses, which are fused together. The electrode is connected with a supply wire (not shown) through an adapter, contained in a sleevelike extension.

the operator. 3. Finally, the amount of leakage of medicinal solution must be reduced to a minimum.

With this object in mind, an electrode has been devised consisting of two contact lenses which are fused together. The inner contact lens has a corneal portion with a radius of 7.5 mm. A curve of this diameter has proved most satisfactory in 90 per cent of all contact lenses fitted [7] and provides sufficient space between lens and cornea to accommodate

7. Obrig., T. E.: Contact Lenses, Philadelphia, The Chilton Company, 1942, p. 256.

the medicinal solution. Four holes with a diameter of 2 mm. are drilled into the limbal portion of the inner lens, at points equidistant from the center.

The outer contact lens fits snugly over the inner one, but the two are fused together in such a manner as to leave enough room to accommodate a platinum electrode with four prongs, which are long enough to extend over the holes drilled into the inner contact lens. In the center of the outer contact lens, an aperture communicates with a sleevelike extension containing an adapter which connects the platinum electrode with a supply wire.

Introduction of the electrode proceeds with the patient either sitting up or lying on his back. As a rule, no anesthesia is required, but instillation of a drop of any of the customary local anesthetics may be indicated with nervous patients, or whenever the eye is hypersensitive.

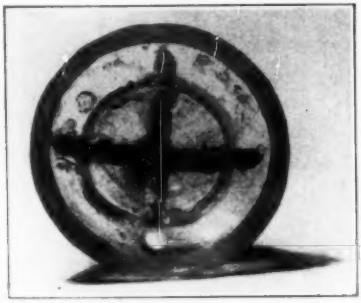

Fig. 2.—View into the cup of the contact lens electrode. The four-pronged platinum electrode is separated from the cornea by the inner contact lens. The current passes through the four holes drilled into the limbal portion of the inner lens, corresponding to the four prongs of the electrode. No direct contact between electrode and cornea can take place.

The penicillin solution is placed in the cup of the inner lens and the appliance inserted like an ordinary contact lens. While holding the electrode by the stem, its upper edge is inserted under the upper lid, with the patient looking downward. The lower lid is then retracted, whereupon the contact lens falls into place. If it is preferred, the medicinal solution may also be introduced after the contact lens electrode has been inserted. The liquid is then instilled with a curved medicine dropper or an irrigator of the type used for the anterior chamber; for this purpose the temporal edge of the lens is slightly lifted and quickly replaced after the solution has been introduced. Irrespective of whether the patient has been sitting up or lying down during introduction of the electrode, the appliance will stay in place during treatment. In order to

keep the contact lens well centered over the cornea, the patient should fix the gaze of the other eye on his hand, or some other object, held straight in front of him at close range.

The success of treatment depends on the presence of a sufficient amount of penicillin at the holes within the inner lens, where the current passes from the electrode to the cornea. For this reason, it matters little whether air has entered into the space between lens and cornea, or whether, inadvertently, the cup has not been completely filled with the solution. If part of the liquid should leak out, enough will remain in the limbal portion of the lens to permit passage of the current into the cornea through at least one or two holes. But even if, accidentally, no fluid should have been left between the inner lens and the cornea, the possibility of injury is excluded because the metal of the electrode can never touch the globe.

A contact lens electrode of the type described here has been used successfully in a considerable number of cases. The opinion may be expressed that the most serious shortcomings inherent in the electrodes formerly used have been eliminated in the new appliance, with the hope that antibiotic ion therapy, as well as iontophoresis using other medicinal solutions, has been made a safer procedure.

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CONGENITAL CYST OF THE VITREOUS

Report of a Case

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CYSTS in the vitreous body of the eye are so uncommon as to be ophthalmologic curiosities. A review of the literature in 1939[1] disclosed only 18 cases of free floating, congenital cysts of the vitreous. Since then, several cysts associated with inflammatory or degenerative processes or congenital cysts attached to the optic disk, hyaloid or other retinal blood vessels have been described.[2] I have found a second congenital cyst floating free in the vitreous nearly identical with the one I previously described.[1]

REPORT OF CASE

History.—R. T., a boy aged 9, was first brought to my office in November 1947. His parents had observed him turning his head to the side to look at a distant object, such as the blackboard at school. An ophthalmologist had fitted him with glasses the previous year, without relief. Neither the boy nor his parents had any explanation for the turning of his head except that he had never been able to see much out of his left eye.

Examination.—The patient was intelligent, cooperative and of normal appearance. Both eyes appeared normal; there was no apparent squint or facial asymmetry. Vision was 20/20 in the right eye and 5/200 in the left eye. The pupils were regular and equal and reacted to light and in accommodation.

The anterior chamber, cornea and iris of both eyes appeared normal. The eyeground of the right eye was normal except for a moving, dark red shadow. The optic disk was normal; there were no prepapillary loops or membrane; the vessels were of normal appearance; the macula and the periphery of the retina were not remarkable.

A round cyst floated in the middle of the vitreous and cast a moving, dark red (called "dark" in legend) shadow on the fundus. With indirect ophthalmoscopy, it appeared as a shadowy, gnarled, floating, oval cyst with a wrinkled surface. It moved and floated about with movements of the eye but returned to its original position near the center of the globe as the movement ceased. With direct ophthalmoscopy, it came into sharpest focus with a +16 D. lens. The cyst was swarthy, bumpy and nodular; it seemed semitransparent, as dark, irregular streaks with lighter background covered its wrinkled surface. With the slit lamp, or, better, with a flashlight, it could be visualized as of yellowish gold color with crinkly surface.

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1. Cassady, J. V.: Congenital Cyst of the Vitreous, Arch Ophth. **21**:45-50 (Jan.) 1939.

2. Saenz Canales, J.: Formaciónes quisticas en el cuerpo vitreo; un caso clinico, An. Soc. mex. de oftal. y oto-rino-laring. **17**:123-139 (July-Aug.) 1942.

Drawing of the fundus showing the cyst floating free in the vitreous. The dark area posterior to the cyst is its shadow on the fundus.

Neither remnants of the hyaloid artery nor Cloquet's canal could be visualized except for the cyst in the vitreous. Refraction of each eye with homatropine cycloplegia showed:

Right eye: +1.00 D. sph.; vision 20/20
Left eye: —14.00 D. sph. ⊃ +4.00 D. cyl., ax. 75; vision 5/200

The left eye had a myopic fundus with an elongated, elliptic disk and a scleral crescent on its temporal side. The vitreous, media, vessels, macula and periphery of the retina appeared normal. The eye was amblyopic without demonstrable anomaly except for the high myopic astigmatism.

The cyst of the right eye was irregular, entirely free floating and unattached by any strand. It rose, turned, settled down, moved to either side but always returned nearly to its original position in or close to Cloquet's canal and the primary vitreous.

After I had described it to Prof. Ida Mann, she wrote: "I suspect the cyst represents a persistence and cystic dilatation of a portion of the anterior end of the nerologic sheath of the hyaloid artery. As it is unattached, but remains in the center of the vitreous, it is presumably in Cloquet's canal, and so must have something to do with vascular remains."

COMMENT

As I previously observed,[1] the apparent pigmentation of the cyst is an illusion, owing to its being seen in silhouette against the light reflected from the illuminated eyeground. Both the cysts described were visible with direct light, as were those of Hurwitz and Meding. They were not dark, but had a hyaline gilded or yellow surface. This, together with their location near the center of the vitreous in Cloquet's canal, suggests that they were a part of the neurologic element of the primitive Bergemeister's papilla, or a remnant of the covering of the hyaloid artery.

The original cyst I described maintains the same appearance as that on first examination, ten years ago, and is almost identical with the one reported here. The fact that I could not easily find it again when I examined the patient recently, suggests that such cysts may be often missed.

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Ophthalmologic Reviews

METABOLISM OF THE CORNEA

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SINCE the greater part of the cornea is remotely situated from the blood stream, this area may present unique mechanisms for the transfer of metabolites and excretory products. This tissue is avascular, but it is surrounded at its periphery by intravascular and extravascular fluid. Furthermore, it is bathed anteriorly and posteriorly with continuously circulating fluids. It is exposed to the atmosphere in the waking hours and yet survives many hours when sealed by the lids during sleep. Even the relatively anaerobic environment in the conjunctival sac of deep-sea-diving mammals and hibernating land forms does not irreversibly disturb the functions of the cornea. It is pertinent, therefore, to inquire: How does the cornea respire? Are its cellular metabolic mechanisms similar to those found in other tissues? If not, in what way do they differ? This report is an attempt to outline the experimental investigation which has been undertaken on these problems, in the hope that a concentration and evaluation of the available literature will assist in the approach to unsolved problems which confront the experimentalist today. Discussions of the various factors involved will be placed under the appropriate headings when possible, but there are many instances of overlapping, and in these cases the discussion appears under the heading of the most important factor involved in a given experiment.

ATMOSPHERIC ENVIRONMENT OF THE CORNEA

As early as 1899, Bullot and Lor [1] transplanted eyes into peritoneal cavities and found that the corneas became opaque in the presence of the low oxygen tensions existing there, but the opacities were limited to areas under intact epithelium. The scraped areas (without epithelium) remained clear. From this study it was concluded that the epithelium withheld oxygen from the endothelium and that only in the presence of the relatively higher oxygen tension (such as exists in the normal

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1. Bullot, G., and Lor, L.: De l'influence exercée par l'épithélium de la cornée sur l'endothélium et le tissu cornéens de l'œil transplante, Bull. Acad. roy. de méd. de Belg. **13**:421, 1899.

environment) could enough oxygen pass through to keep the endothelium viable.

Fischer [2] (1930) studied these changes in vivo by the use of a glass chamber which fitted snugly to the luxated eye. Known gases were introduced, and samples could be removed for analysis at the end of an experimental period. Fischer corroborated the findings of Bullot and Lor when he noted an increase in the oxygen consumption and in the production of carbon dioxide following the removal of epithelium from the living eye. He came to the conclusion that this layer acts as a barrier to the exchange of gases without itself entering into the process of utilizing oxygen or producing carbon dioxide. He reasoned thus because he did not find a lowering of oxygen consumption or carbon dioxide production accompanynig deepithelization. Finally, he stated the belief that the oxygen was utilized by the endothelium and the carbon dioxide produced passed anteriorly to the outside atmosphere. This view was substantiated by the experimental demonstration of corneal opacities in an atmosphere of pure carbon dioxide, which (according to Fischer) hinders the diffusion of excretory gases from the cornea and results in endothelial necrosis. Thus, Fischer envisaged the combination of the corneal epithelium, glass membranes and stroma as a glorified blood capillary wall with respect to the exchange of gases concerned with the endothelial respiration. This view was undoubtedly influenced by the incorrect belief which prevailed at the time, that the endothelium was the all-important structure for the control of fluid traffic through the cornea. Fischer's work was justifiably criticized by Bakker [3] (1947) as not being performed under optimal physiologic conditions. While Bakker unjustly cited Fischer's statements out of context, he appeared to be fair in stating that luxated eyes on which were placed snugly fitting bell type chambers, compressing ocular circulation, were not under normal in vivo conditions. Furthermore, he pointed out Fischer's complete indifference to the circulation of the limbal arcade. It is interesting to note that from the experiments performed by Bakker, which were also unphysiologic, the same results were obtained in an atmosphere of 100 per cent carbon dioxide, although the interpretation is quite different. This investigator, who had earlier (Bakker,[4] 1941) found carbonic anhydrase in the cornea and assumed it was present to facilitate the removal of carbon dioxide in the absence of blood vessels, decided to reinvestigate Fischer's work on the selective permeability of

2. Fischer, F. P.: Ueber den Gasaustausch der Hornhaut mit der Luft, Arch. f. Augenh. **102**:146, 1930.

3. Bakker, A.: Some Researches on the Respiration of the Cornea in Albino Rats, Brit. J. Ophth. **31**:100, 1947.

4. Bakker, A.: Der Kohlensäureanhydrasegehalt verschiedener Augengewebe einiger Säugetiere, Ophthalmologica **102**:351, 1941.

the cornea in the living eye. His technic of maintaining an animal in a closed chamber with artificial respiration through taps to the outside eliminated some of the artefacts produced by Fischer's technic, but it is important to realize that even here the eyes might not have been under strictly optimal physiologic conditions. The animals were subjected to general anesthesia, and the lids were sutured open throughout the experiment. At the beginning of the procedure the entire animal was completely submerged in a physiologic saline fluid, and the environmental gases were saturated with water vapor, which may have also altered the normal in vivo conditions. As in Fischer's experiments, no changes were noted in the corneas remaining in a pure nitrogen atmosphere for twelve hours. Therefore, it was concluded that the cornea did not obtain oxygen from the atmosphere, and the fact that diving whales and sleeping persons do not experience corneal changes was held to be consistent with these findings. Bakker expressed doubt of the selective permeability of the cornea to carbon dioxide; he demonstrated that the cornea (as shown by histologic examination) could be maintained at carbon dioxide (8 per cent carbon dioxide; 92 per cent nitrogen) tensions much higher than those of the body, and that it became opaque only in an atmosphere of 100 per cent carbon dioxide. Thus, the corneal changes were not caused by an impediment to removal of carbon dioxide, but resulted from the toxic effect of the high concentration of carbon dioxide per se.

In a different manner, Gundersen [5] (1938-1939) obtained evidence that the epithelium degenerated when exposed to low oxygen tension. Invariably, the epithelium of autotransplants of cornea into the anterior chamber disappeared in the aqueous substrate. This was noted even when the transplant was nourished by the iris, a phenomenon which occurred in all but one experiment. The stroma remained intact; indeed, the endothelium flourished in that it enveloped the transplants in all the experiments. He concluded that the epithelium utilized oxygen directly from the atmosphere.

Comment.—The observations of Bullot and Lor and the findings of Gundersen might possibly be ascribed to other physiologic phenomena, such as osmotic effects, rather than to gas tensions. Both Fischer and Bakker demonstrate the toxic effects of high carbon dioxide tensions, but the latter, in his nitrogen experiment, clearly proved the absence of any effect due to low oxygen tension. Can the corneal strata utilize oxygen directly from the atmosphere? Most tissues in the mammalian body depend on oxygen from the blood stream as their source of this

5. Gundersen, T.: (*a*) Results of Autotransplantation of Cornea, Tr. Am. Ophth. Soc. **36**:207, 1938; (*b*) Vascular Obliteration for Various Types of Keratitis: Its Significance Regarding Nutrition of Corneal Epithelium, Arch. Ophth. **21**:76 (Jan.) 1939.

element. However, there is a lack of information on the relation of such tissues as mucous membranes to atmospheric oxidation. The burden of proof is on those who assume the corneal tissue to be unique in its procurement of oxygen directly from the atmosphere, as compared with other tissues, which are supplied exclusively by the oxygen borne in the blood stream. Therefore, the question is still unsolved.

METABOLISM IN THE VARIOUS CORNEAL STRATA

As already mentioned, Bullot and Lor[1] (1899) and also Bullot[6] determined that the endothelium requires considerable oxygen for its maintenance. These experimenters described a "wave of asphyxia" in the corneal endothelium, extending from the periphery toward the center in the presence of a decreased oxygen tension. However, just the reverse occurred in a toxic oxygen excess: the central endothelium died early, whereas the periphery showed relative resistance. According to Bakker[3] (1947), Bullot's experiments suggested that oxygen from the atmosphere was utilized by the endothelium; but, since the eyes were enucleated and the corneal epithelium was scraped off, the conditions were too far from physiologic to permit one to conclude whether or not oxygen from the air moves toward the anterior chamber in living animals.

Fischer[2] (1930) presented evidence of the respiratory activity of the endothelium in the cornea. He dismissed the epithelium as an inactive participant. Rauh's[7] (1934) results differed from Fischer's. By the reduction of nadi reagent (equal parts of 1 per cent aqueous solutions of dimethylparaphenylendiamine and alpha-naphthol), he showed that all cells of the cornea entered into a definite respiratory cycle. These results, though crude, were substantiated in 1935 by Kohra[8] (table), who was the first to attempt to measure accurately the respiration of the cornea by the Barcroft-Warburg[9] (1926) technic. Kohra's article was published in Japanese, but Süllman[10] (1938) and Weekers[11] (1940) referred to the work and stated that a corneal opacity

6. Bullot, G.: (*a*) Sur la physiologie de l'epithélium cornée: imperméabilité relative à l'oxygène, Bull. Acad. roy. d. sci. de Belg., 1900, p. 887; (*b*) Bruxelles, Hayex, 1900; (*c*) On the Action of Oxygen at Low and High Pressure upon the Corneal Endothelium, J. Physiol. **31**:359, 1904.

7. Rauh, W.: Beitrag zur Zellatmung der Hornhaut, Ber. ü d. Versamml. deutsch. ophth. Gesellsch. **50**:212, 1934.

8. Kohra, T.: Ueber den Stoffwechsel der Hornhaut, Acta. soc. ophth. jap. **392**:1429, 1935; German summary, p. 107.

9. Warburg, O.: The Metabolism of Tumors, translated by F. Dickens, New York, Richard R. Smith, Inc., 1931.

10. Süllman, H.: Biochimie des Auges, Ophthalmologica **96**:37, 1938.

11. Weekers, R.: Biochimie de la cornée normale et pathologique, Ophthalmologica **100**:136, 1940.

was noted in deep layers within three to five hours after the ciliary arteries were ligated. This was ascribed to a decreased endothelial metabolism. Interruption of the pericorneal circulation was without effect. Kohra found that the metabolism of the total cornea in the presence of ischemia immediately following ligation of the ciliary arteries remained constant and finally increased, whereas the metabolism of the endothelium fell rapidly. In his opinion, the primary cause of corneal opacity secondary to uveal disease is the lack of nourishment in the endothelium. Kohra compared the respiration of the whole cornea and of the various strata in aqueous and in Ringer's solution and found that the respiration was greater in the former and less in the latter. However, the reverse was true for aerobic glycolysis, while anaerobic glycolysis

Determinations of Corneal Respiration

Author	Animal	Tissue	QO_2*	O_2 QM†	N_2 QM‡
Kohra [5] (1935)	Rabbit	Entire cornea	−1.56	+1.18	+2.32
		Epithelium	−4.80	+4.60	+8.01
		Stroma	−0.79	+0.73	+1.38
		Endothelium	−6.00	+4.70	+1.05
Bessey [12] (1939)	Rat	Entire cornea	−4.00	.....	.....
Orzalesi [13] (1939)	Rabbit	Entire cornea	−2.09	.....	+3.05
Fischer [14] (1940)	?	Entire cornea	−1.71	+0.42	+2.34
		Epithelium	−6.15	+1.59	+8.00
		Stroma	−0.93	+0.69	+1.40
		Endothelium	−7.93	+2.50	+10.80
Herrmann and others [16] (1942)	Cow	Entire cornea	−0.54 (calculated assuming dry weight to be 150 mg.)		
Lee and Hart [18] (1944).....	Rat	Entire cornea	−2.24 (calculated assuming dry weight to be 1.0 mg.)		
		Epithelium	1.16 cu. mm. oxygen per cornea		
		Stroma	0.44 cu. mm. oxygen per cornea		
Shestericova and Rosenfeld [21] (1946)	?	Epithelium	−4.03; −3.10; −7.45		Corneas stored up to 17 days
		Stroma	−0.108; −0.215; −0.201		
		Endothelium	0.0; 0.0		
Robbie and others [22] (1947)..	Rabbit	Entire cornea	−0.46		
		Epithelium	−6.0 to −8.0 (estimated)		
		Stroma	−0.15		

* QO_2 indicates oxygen uptake, expressed in cubic millimeters per milligram per hour.
† O_2QM refers to aerobic glycolysis.
‡ N_2QM refers to anaerobic glycolysis.

was independent of the medium. He concluded that the susceptibility to damage in experimental mediums was greatest in the endothelium, less in the epithelium and least in the stroma. Bessey [12] (1939) showed that the oxygen consumption of the whole rat cornea was 4 cu. mm. of oxygen per milligram (dry weight) per hour (table), as measured by the Barcroft-Warburg technic. In Gundersen's [5] (1938) opinion, this oxygen consumption was due principally to the active epithelium. Orzalesi [13] (1939) repeated Kohra's work on human, rabbit and rat

12. Bessey, O. A., cited by Gundersen,[5b] p. 80.

13. Orzalesi, F.: Richerche sulla respirazione e sulla glicolisi della cornea, Boll. d'ocul. **18**:509, 1939; Zentralbl. f. d. ges. Ophth. **44**:537, 1940.

corneas, and he decided that it was impossible to measure the respiration of the endothelium alone because the trauma involved in its removal lowered its respiratory capacities. However, he stated the belief that the endothelium must have an active metabolism, since it alone was responsible for the uptake of oxygen after the epithelium was removed, as no respiration could be demonstrated from the parenchyma alone. He attributed a definite consumption of oxygen and breakdown of carbohydrate to the epithelium. Orzalesi concluded that the metabolism of the cornea varied inversely with the mass, since the main bulk of the cornea consists of relatively inert stroma, the epithelium making up a small portion of the total volume or weight, and the endothelium still less (table).

Fischer[14] (1940) reported values for the various portions of the cornea which differed from those in his earlier work and estimated that the oxygen intake (QO_2) of the epithelium and of the endothelium was equal to 3.5 to 4.5 times that of the whole cornea (table). Furthermore, both layers showed considerable aerobic and anaerobic glycolysis. He concluded, therefore, that the classic view (Duke-Elder,[15] 1933) of a "slow" corneal metabolism was no longer acceptable. He gave values for the various layers but, unfortunately, described neither his technics nor his experimental animals.

Herrmann, Moses and Friedenwald[16] (1942) studied the effects on corneal respiration of local anesthetics and other drugs used topically in ophthalmology. They concluded that the metabolism of the cornea involves glycolysis and oxygen activation (cytochrome–cytochrome oxidase complex and dehydrogenation with intermediate carriers) (table). Cyanide, tetracaine, chlorobutanol, pentobarbital sodium, phenacaine, butacaine sulfate, atropine and cocaine were found to inhibit oxygen consumption of the bovine cornea to varying extents. One human cornea removed with the use of a local anesthesia was also found to be greatly depressed. Ephedrine and urethane (ethyl carbamate), though they readily inhibited the isolated enzyme systems, were without effect on the intact cornea. The authors postulated that this lack of inhibition may have been due to the inability of the pharmacologic agents to reach the enzyme systems in the intact organ, thus suggesting that the cornea may become a valuable tool in the study of respiratory systems. Since tetracaine and chlorobutanol did not affect the oxidation of cytochrome c,

14. Fischer, F. P., in Ridley, F., and Sorsby, A.: Modern Trends in Ophthalmology, New York, Paul B. Hoeber, Inc., 1940, p. 351.

15. Duke-Elder, W. S.: Text-Book of Ophthalmology, St. Louis, C. V. Mosby Company, 1933, vol. 1, p. 471.

16. Herrmann, H.; Moses, S. G., and Friedenwald, J. S.: Influence of Pontocaine Hydrochloride and Chlorobutanol on Respiration and Glycolysis of the Cornea, Arch. Ophth. **28**:652 (Oct.) 1942.

the dehydrogenation of lactic or malic acid or glycolysis, it was difficult to explain the inhibition of respiration and the accumulation of lactic acid in the tissues (as measured by the highly specific technic of Barker and Summerson,[17] 1941). Herrmann and associates assumed that the effect may have been on some carrier between lactic acid dehydrogenase and cytochrome oxidase. Possibly the drugs enhanced aerobic glycolysis (anaerobic glycolysis was not affected). They may have inhibited the resynthesis of lactic acid into dextrose; or perhaps, as suggested by these workers, the accumulation of lactic acid may have been a side reaction occurring in the respiring cornea.

Lee and Hart[18] (1944) determined that the oxygen consumption per hour for the whole rat cornea was 2.24 cu. mm., that for the epithelium 1.16 cu. mm. and that for the stroma 0.44 cu. mm. (table). They were unable to measure the endothelial respiration. The discrepancy between the sum of the stromal value and the epithelial value as compared with that for the intact cornea was interpreted by these authors as representing a result of the cellular trauma inherent in the mechanical removal of the epithelium from the cornea.

Both Orzalesi[19] (1939) and Lee and Hart[18] (1944) found the metabolic activity of the vitamin A–deficient (xerotic) cornea to be higher than normal. This was due to an increase in the epithelial respiration, since the stromal respiration did not change. Lee and Hart attributed the increased respiration to the metaplasia and hyperplasia of the epithelial cells. Orzalesi, who also noted an increase in the glycolytic activity of the xerotic cornea, concluded that the pronounced necrotic changes in the tissues might liberate substances capable of accelerating metabolism.

Lee and Hart[18] (1944) also investigated the respiration of the vascularized, riboflavin-deficient rat cornea and found the respiration in the later stages to be the same as that for normal controls. However, when the epithelium was measured alone, its oxygen consumption was markedly depressed. This depression occurred early in the deficiency; and when the respiration of the whole cornea was measured at this time it was found to be low, since no change in the stromal rate had occurred. Later, however, after parenchymal invasion of the blood vessels and cellular elements, the stromal respiration increased and thus accounted for the over-all normal values obtained from the intact corneas.

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17. Barker, S., and Summerson, W. H.: The Colorimetric Determination of Lactic Acid in Biological Material, J. Biol. Chem. **138**:535, 1941.

18. Lee, O. S., and Hart, W. M.: The Metabolism of the Cornea, Am. J. Ophth. **27**:488, 1944.

19. Orzalesi, F.: Richerche sulla glicolisi e respirazione della cornea di ratto albino in avitaminosa A, Boll. d'ocul. **18**:442, 1939; Zentralbl. f. d. ges. Ophth. **44**:536, 1940.

Hart and Lee [20] (1945) were unable to confirm the results of Herrmann and his associates concerning the effects of cocaine on the corneal respiration. They found an increase in oxygen uptake by the cornea in the presence of 5 per cent cocaine. However, their studies were made on rat corneas, whereas Herrmann's group employed the bovine cornea. Both groups were agreed on the inhibitory effects of tetracaine and cyanide.

Shestericova and Rosenfeld [21] (1946) investigated the respiration of the cornea during preservation. They reported an increase in respiration during the first six days, but on the seventeenth day the respiration had fallen to about 50 per cent of normal. Their values for oxygen consumption for the various strata are tabulated in the table. They compared Ringer's solution with aqueous as a substrate and found a high respiratory rate for the epithelium in both solutions. The stromal oxygen consumption was insignificant, in their opinion; the endothelial respiratory rate, which was zero in Ringer's solution, was revived in an aqueous medium. This observation substantiated Kohra's findings. They also reported a 60 to 80 per cent reduction of respiration in the presence of hydrogen cyanide.

Robbie, Leinfelder and Duane [22] (1947) applied the technic of controlled cyanide inhibition as perfected by Robbie [23] (1946) to the rabbit cornea in the Warburg apparatus. They found 50 per cent inhibition in concentrations of 10^{-4} molar hydrogen cyanide and 93 per cent inhibition in solution of 10^{-3} molar hydrogen cyanide. The remaining 7 per cent may have been associated with a non-metal-bearing, riboflavin-containing carrier. They demonstrated the labile linkage between the heavy metal and cyanide and stressed the importance of maintaining a constant hydrogen cyanide tension in this type of study. Furthermore, they showed that the cornea could be washed free of the cyanide and that the normal respiratory rate was resumed if glucose were present in the substrate. Robbie and his associates postulated that the cornea subsisted on glycolytic energy while under cyanide inhibition because they could demonstrate recovery when the cyanide was removed at the end of a five hour period only in those corneas which were in a glucose substrate; without glucose there was no

20. Hart, W. M., and Lee, O. S.: The Influence of Pontocaine, Cocaine, Procaine and Cyanide on the Uptake of Oxygen by the Cornea and the Effect of Added Substrate, Proc. Am. Federation Clin. Research, 1947, vol. 3.

21. Shestericova, T., and Rosenfeld, E.: The Respiration of the Cornea During Preservation, Ukranian Biochem. J. **18**:201, 1946.

22. Robbie, W. A.; Leinfelder, P. J., and Duane, T. D.: Cyanide Inhibition of Corneal Respiration, Am. J. Ophth. **30**:1381, 1947.

23. Robbie, W. A.: The Quantitative Control of Cyanide in Manometric Experimentation, J. Cell. & Comp. Physiol. **27**:181, 1946.

recovery. Finally, the scraped cornea responded to cyanide inhibition like the whole cornea, showing the effect of hydrogen cyanide on the stroma. They found a mean oxygen consumption (QO_2) of —0.46 for the entire cornea and —0.15 for the stroma. The epithelium was estimated to have an oxygen consumption of —6.0 to —8.0 (table 1). They stressed the adaptability of the cornea as a tool for tissue respiratory studies because it maintained a constant rate of respiration for more than six hours in a Ringer-phosphate solution.

Grant [24] (1947) studied the effects of the sulfur dioxide gas on the corneas of experimental animals after reviewing the effects of this compound on 4 human subjects whose corneas had been accidentally exposed to liquid sulfur dioxide. He found a complete inactivation of corneal catalase. He concluded that the toxic effect was due to sulfurous acid, which denatured the corneal proteins, including the enzymes.

Anderson [25] (1947) attempted, without success, to reproduce the corneal and conjunctival pigmentation found clinically in workers engaged in the manufacture of quinone and hydroquinone. He concluded that a specific intracellular oxidase necessary for the formation of a melanin-like substance might be missing in the experimental albino rabbits.

The February 1948 issue of the *Bulletin of the Johns Hopkins Hospital* [26] is devoted to experimental work performed at the Wilmer Institute during World War II on mustard gas burns (dichloroethyl sulfide) burns of the eye. The monograph describes in detail the various aspects of this problem as it was approached by the many workers in their laboratory group from 1941 to 1945. Over one-half the report contains descriptions, results and interpretations of Herrmann's experiments on the metabolic processes as they were influenced by mustard gas injury. This necessitated the investigation of many metabolic reactions in the normal control corneas in order to evaluate the changes produced by mustard gas.

They found a normal mode of glycolysis in the corneal epithelium under aerobic and anaerobic conditions. They stated that the stroma did not take up oxygen but that this layer was capable of utilizing glucose and of producing lactate, which could be utilized only by the

24. Grant, W. M.: Ocular Injury Due to Sulfur Dioxide: II. Experimental Study and Comparison with Ocular Effects of Freezing, Arch. Ophth. **38**:762 (Dec.) 1947.

25. Anderson, B.: Corneal and Conjunctival Pigmentation Among Workers Engaged in Manufacture of Hydroquinone, Arch. Ophth. **38**:812 (Dec.) 1947.

26. Staff of Wilmer Institute: Studies on the Physiology, Biochemistry and Cytopathology of the Cornea in Relation to Injury by Mustard Gas and Allied Toxic Agents, Bull. Johns Hopkins Hosp. **82**:81, 1948.

epithelium. Thus the rate of glucose consumption in the stroma seemed to be under the control of the epithelium; i.e., there seemed to be an "intercellular Pasteur effect" operating in this tissue. The epithelial control was exerted through its supply of phosphates with high energy bonds. Mustard gas interfered with these processes, and the possible mechanisms of interference were discussed in detail. A special hydrogen transport mechanism for the epithelial utilization of stromal lactate, which did not operate in the endogenous consumption of epithelial lactate, was postulated. Lactate, pyruvate, serine and butyrate were not consumed by the stroma but were metabolized in the epithelium. Furthermore, glutathione and ascorbic acid were found in higher concentrations in the epithelium than in the stroma. These facts suggested that a complex boundary existed between the epithelium and the stroma and that expenditure of energy was necessary for the maintenance of the cohesive forces between these layers. Under Friedenwald's influence, and stimulated by his successes on similar interface boundary complexes, such as he found in the ciliary body, it was to be expected that this experimental team would search for analogous mechanisms in the stroma-epithelium boundary. The results have been less brilliant in this area, but the effects of known glycolytic enzyme inhibitors, such as mustard gas, iodoacetate and fluoride, on the loosening of the epithelium aerobically and anaerobically have at least suggested many theories and methods of approach, for which investigators in this field are deeply indebted to this group. The theories and hypotheses, as well as the results which accumulated during four years of secret research, are too extensive to be reviewed in detail in this article. The reader is referred to the original monograph. As Friedenwald stated in his final comment:

> A series of unsupported hypotheses have been introduced chiefly centering around the assumption that the metabolic interaction may be located at the boundary of cohesion. There are very serious reasons for believing any such unifying theory is untrue, . . .

A more adequate evaluation of the theory may be made after the results have been confirmed in other laboratories.

Leinfelder [27] (1948) studied aerobic glycolysis in rabbit and bee corneas by the Summerson [28] (1939) technic. When the glucose concentration in the substrate was reduced to less than 0.2 mg. per cubic centimeter, glycolytic processes ceased, but they were restored when additional glucose was supplied. He also found a much higher rate of glycolysis in the epithelium than in the stroma. He compared

27. Leinfelder, P. J.: Glycolytic Activity of Corneal Tissue, to be published.

28. Summerson, W. H.: A Combination Simple Manometer and Constant Volume Differential Manometer for Studies in Metabolism, J. Biol. Chem. **131**:579, 1939.

the glycolytic activity of the fresh and that of the stored cornea and concluded that when the cornea was stored without available glucose there might have been a shift in the p_H of the tissue toward the alkaline side.

Comment.—With the evolution of more sensitive technics, experimenters have come to agree on certain aspects of corneal respiration. All workers agree that the epithelium respires a certain amount, but there is some question about the stroma and the endothelium. The value of the individual oxygen consumption for a given tissue layer in a given species remains unsettled. The effects of certain anesthetic drugs have been corroborated by at least two groups, although the effect of cocaine on corneal respiration is debated. Evidence has been presented to show that a heavy metal system, probably cytochrome–cytochrome oxidase, is directly involved in the respiratory events in the cornea. Furthermore, the cornea is capable of carrying on aerobic and anaerobic glycolysis and, indeed, may depend on the latter under low oxygen tensions. The exact role of riboflavin, i.e., whether it acts as an autoxidizable substance or whether it behaves as a flavoprotein link between the dehydrogenases and the cytochrome systems, is still unsolved. The practical value of an answer to the question becomes apparent when it is recalled that corneal vascularization accompanies riboflavin deficiency, probably because of a need for increased supply of oxygen to the corneal epithelium. There is evidence that the cohesive attraction of epithelium to stroma is under the control of forces which are enzymatically generated near the boundary and that these forces can be altered with glycolytic enzyme inhibitors, including mustard gas. The changes which occur in the stored cornea have been investigated, and it is possible that longer periods of preservation in eye banks may result from study of these phenomena. Finally, quite aside from the practical application to opthalmology, the recent studies on corneal respiration have proved that this organ is an endurable and valuable material for laboratory investigations.

THE FLUID ENVIRONMENT OF THE CORNEA

Coccius [29] (1852) noted that the cornea remained viable when the anterior chamber was filled with air, and Gruber [30] (1894) reported that the cornea remained transparent after a complete peritomy. Hence, from these early years, it was believed that the cornea had a dual source of nourishment from the pericorneal vessels and from the aqueous,

29. Coccius, E. A.: Ueber die Ernährungsweise der Hornhaut und die Serumführenden Gefasse in menschlichen Körper, I. Müller, Leipzig, 1852.

30. Gruber, R.: Beiträge zur Kenntniss der Hornhaut Circulation, Arch. f. Ophth. **40**:25, 1894.

either of which was sufficient to maintain transparency and viability. Laquer [31] (1872) and Gruber [30] (1894) produced further evidence for this hypothesis from the observations that rust spots in the cornea became blue after injection of potassium ferricyanide into the blood stream or into the anterior chamber.

Weekers [11] (1940), in a review article, discussed the contradictory results of various workers on the permeability of the cornea with regard to oxygen, carbon dioxide and mineral salts. He lamented the gaps in the knowledge of the metabolism of the cornea and stated that it was difficult, if not impossible, to trace a coherent scheme of chemical changes taking place in this tissue. Parenthetically, one should note that this ignorance extends to most tissues. Since the normal temperature of the cornea is less than that of the iris (Duke-Elder,[32] 1927), it is probable that the metabolism of the cornea is correspondingly less. Weekers discussed the three theoretic sources of substrate for corneal metabolism—the aqueous, the tears and the limbal capillaries. Leber [33] (1903), without experimental evidence, attributed the main role to the limbal capillaries, which supposedly satisfied the periphery of the cornea but left the center in a precarious position.[34] Wessley [35] (1905), while not denying the role of the limbal capillaries, stated the opinion that the chief energy for corneal metabolism stemmed from the aqueous. Terry [36] (1939) recognized three sources of nutritive substances, and Rollet [37] (1936) attached main importance to the tears. Weekers concluded that in reality the findings were too incomplete to permit any formal conclusions, but suggested that the substances most directly utilized in the metabolism of the cornea were oxygen and glucose.

31. Laquer, L.: Ueber die Durchgängigkeit der Hornhaut für Flüssigkeiten, Centralbl. f. d. med. Wissensch. **10**:577, 1872.

32. Duke-Elder, W. S.: Nature of the Intraocular Fluid, Brit. J. Ophth., monograph supp. III, 1927.

33. Leber, T., in Graefe, A., and Saemisch, T.: Handbuch der gesamten Augenheilkunde, ed. 2, Leipzig, W. Englemann, 1903, vol. 2, p. 355.

34. This particular point of view was supported by the experiments of Cogan and Kinsey (The Cornea: V. Physiologic Aspects, Arch. Ophth. **28**:661 [Oct.] 1942), though they differed notably from Leber in the interpretation of other physiologic properties of the cornea, the role of the endothelium, for example. (The reviewer has attempted to determine whether there was a gradient of respiration from periphery to center in the bovine and rabbit total cornea and has obtained inconclusive results, owing to the low oxygen consumption of these tissues.)

35. Wessley, K.: Der Flüssigkeits-und Stoffwechsel des Auges mit besonderer Berücksichtigung seiner Beziehungen zu allgemeinphysiologischen und biologischen Fragen, Ergebn. d. Physiol. **4**:565, 1905.

36. Terry, T.: Some Physiological and Anatomical Aspects of the Cornea Affecting Its Pathology, Am. J. Ophth. **22**:153, 1939.

37. Rollet, J.: La couche de liquide pré-cornéene, Arch. d'opht. **53**:111 and 255, 1936.

The presence of sugar in the tears was admitted by some authors and denied by others (Terry [38] [1939]; Ridley [38] [1930]; Michail, Vanca and Zolog [39] [1937]). By contrast, the presence of the reducing substance in the aqueous could not be denied, and it was plausible to admit that an important part of the reducing power could be attributed to glucose. But as Kinsey [40] has suggested, one must realize that ascorbic acid, which is present in the aqueous,[41] might also account for the reductions. It was impossible to estimate the importance of glucose in the capillary system. The tears, aqueous and blood could all furnish oxygen to the cornea. By virtue of its situation, the cornea was better able to metabolize aerobically than the lens. Weekers also cited the work of Bullot.[6b] Whether the metabolic exchanges occur in the epithelium, endothelium or parenchyma was, he thought, a moot question. He stated that "at the most it can be noted that certain substances, not elements of the structure, are found in the cornea—perhaps products of diffusion, possibly metabolic substrates and by-products—such substances as malic acid, creatine, citric acid (Krause and Stack [42]), formic acid (Krause and Weekers [43]) and inositol (Krause and Weekers [44])." Weekers concluded that with more research the etiology of keratitis will unfold and the number of successful corneal grafts will increase.

FINAL COMMENT

There are many conflicting opinions about the various factors which influence the respiration of the cornea, but one thing is clear:

> It is impossible for us to understand or properly treat the degenerative diseases of the cornea until we have a sound knowledge of the corneal metabolism and the changes therein wrought by injury and disease.[45]

38. Ridley, F.: The Intraocular Pressure and Drainage of the Aqueous Humor, Brit. J. Exper. Path. **11**:217 (1930).

39. Michail, D.; Vanca, P., and Zolog. C. R.: Sur l'elimination lacrymale du glucose chez les diabetiques, Compt. rend. Soc. de biol. **125**:194, 1937.

40. Kinsey, V. E.: Personal communication to the author.

41. Friedenwald, J. S.; Buschke, W., and Michel, H. O.: Role of Ascorbic Acid (Vitamin C) in Secretion of Intraocular Fluid, Arch. Ophth. **29**:535 (April) 1943. Kinsey, V. E.; Jackson, B., and Terry, T. L.: Development of Secretory Function of the Ciliary Body in the Rabbit Eye, ibid. **34**:415 (Nov.-Dec.) 1945. Kinsey, V. E.: Transfer of Ascorbic Acid and Related Compound Across the Blood Aqueous Barrier, Am. J. Ophth. **30**:1262, 1947.

42. Krause, A. C., and Stack, A. M.: Citric and Malic Acids of the Ocular Tissues, Arch. Ophth. **22**:66 (July) 1939.

43. Krause, A. C., and Weekers, R.: L'acide formique des tissus oculaires, Arch. d'opht. **3**:225, 1939.

44. Krause, A. C., and Weekers, R.: Inositol in Ocular Tissues, Arch. Ophth. **20**:299 (Aug.) 1938.

45. Woods, A. C.: The Present Policies of the American Board of Ophthalmology and the National Societies in Relation to the Progress of Ophthalmology, Tr. Am. Acad. Ophth. **52**:5, 1947.

This statement, made by Alan Woods in his provocative presidential address before the American Academy of Ophthalmology and Otolaryngology, suggests the challenge to investigators in this area.

SUMMARY

The literature on the respiratory activity of the cornea is reviewed with respect to several aspects. The relation of corneal respiration to the atmospheric environment is analyzed. The respiratory rates of the various corneal strata are collected, evaluated and recorded in tabular form. Evidence for the presence and operation of the various respiratory enzyme systems is discussed. Finally, the possible sources of nutrition for the cornea are reviewed.

Medical Laboratories.

News and Notes

EDITED BY DR. W. L. BENEDICT

GENERAL NEWS

Oregon Academy Postgraduate Convention in Ophthalmology and Otolaryngology.—The Oregon Academy of Ophthalmology and Otolaryngology has announced its tenth annual spring convention, to be held from June 19 to June 24, 1949.

The guest speakers will be: Dr. Lawrence R. Boies, professor of otolaryngology, University of Minnesota Medical School, who will discuss chronic conditions of the ear and nose and current problems in otolaryngology; Dr. Leland Hunnicutt, associate clinical professor of otolaryngology, University of Southern California School of Medicine, who will speak on hemorrhagic problems in the ear, nose and throat, and Dr. Edmund B. Spaeth, professor of ophthalmology, University of Pennsylvania School of Medicine, who will discuss surgery of the eye.

Round table luncheon discussions will be held daily.

Fee for the postgraduate convention is $75, which includes the cost of daily luncheons.

Royal Australasian College of Surgeons.—The twenty-second annual general meeting of the Royal Australasian College of Surgeons will be held in Brisbane, June 7 to 10, 1949. A preliminary program of the meeting includes, for the section of laryngo-otology, papers on sinusitis in children, tumors of the pituitary gland, bilateral abductor laryngeal paralysis, control of vertigo and the fenestration operation. In the section for ophthalmology, lectures will be given on aspects of the treatment of intraocular tumors, orbital tumors, surgery of the inferior oblique muscle, dacryocystorhinostomy and pathology of the eye. Dr. H. G. Wheeler, of Melbourne, is secretary of the College.

Postgraduate Lectures, University of Glasgow.—The University of Glasgow, Department of Ophthalmology, has announced a series of postgraduate lectures to be given in May 1949. The lectures are scheduled as follows:

May 4: "European Vacation," Prof. W. J. B. Riddell; May 11: "Pupillary Movements," Dr. Forgus Campbell; May 18: "Structure of the Vitreous Humour," Dr. Antoinette Pirie; May 25: "Bleeding and Clotting Within the Eye," Dr. W. O. G. Taylor.

SOCIETY NEWS

Midwestern Section of the Association for Research in Ophthalmology.—The Midwestern Section of the Association for Research in Ophthalmology held its organizational meeting in the Elliott Auditorium, Oscar Johnson Institute, St. Louis, on Saturday, March 26, 1949. William F. Hughes Jr., M.D., was elected chairman; William Howard Morrison, M.D., vice chairman, and T. E. Sanders, M.D., secretary

and treasurer. The scientific program was enjoyed by sixty-five ophthalmologists, from Ohio, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Nebraska, Kansas and Missouri.

Papers covering a wide range of scientific research in ophthalmology were presented.

Association for the Prevention of Blindness (Mexico).—The medical staff of the Mexican Association for the Prevention of Blindness announces its annual meeting, to take place from November 6 to 13, 1949, at the Association Hospital, México, D. F., Mexico.

Papers to be presented must be sent to the association not later than Oct. 1, 1949, and must take not more than fifteen minutes in reading time and presentation of slides.

The fee for inscription at the meeting is 50 pesos (Mexican).

Western Section of the Association for Research in Ophthalmology.—The section's annual meeting was held on March 25, 1949 at the University of California Medical School. A scientific program of general interest was presented, followed by a general meeting, at which "Aspects and Activities of the Central Nervous System" was discussed by Prof. John B. DeC. M. Saunders, F.R.C.S., professor of anatomy and lecturer in medical history at the University of California Medical School.

Alabama Academy of Ophthalmology and Otolaryngology.—The Alabama Academy of Ophthalmology and Otolaryngology announced its formation on April 20, 1949. The following officers were elected: Chairman, Dr. Frank Clements, of Birmingham; chairman elect, Dr. Phil P. Gilchrist, of Mobile; secretary-treasurer, Dr. Karl B. Benkwith, of Montgomery. Committees on credentials and by-laws are now being appointed by the chairman.

Obituaries

JOHN ELMER WEEKS, M.D.

1853–1949

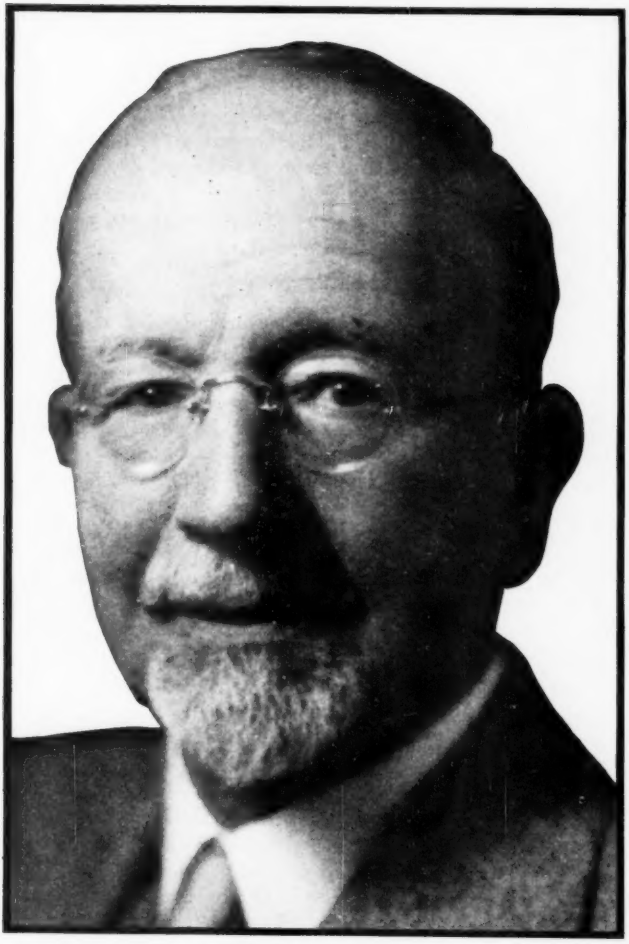
Dr. John Elmer Weeks was born in Painesville, Ohio, Aug. 9, 1853, the son of Seth and Deborah Blydenburgh Weeks, and died in La Jolla, Calif., Feb. 3, 1949. After a preliminary education in the schools of Painesville, and in Corry, Pa., he graduated in medicine from the University of Michigan, in 1881, and engaged in general practice in Corry, Pa., and Hamlet, N. Y., until Feb. 1, 1882.

He was an intern of the Work House Hospital, New York, from April 1, 1882 to April 1, 1883, and resident physician at the New York Emigrant Hospital from April 1, 1883 to April 1, 1885.

Dr. Weeks began his training in ophthalmology under Dr. Herman Knapp at the New York Ophthalmic and Aural Institute. He first attended the outpatient department in 1883 and then acted as resident from 1884 to 1886. It was in the laboratory of this hospital that Dr. Weeks, in 1886, investigated acute contagious epidemic conjunctivitis ("pink eye") and discovered the causative organism, which has become known as the Koch-Weeks bacillus (Weeks, J. E.: The Bacillus of Acute Conjunctival Catarrh, or Pink Eye, *Arch Ophth.* **25:** 441-451, 1886). Dr. Weeks acted as assistant surgeon and instructor in this institution from 1887 to 1889, as well as chief of the clinic in the department of ophthalmology in the New York University Medical College from 1886 to 1888, and occupied a similar position at the College of Physicians and Surgeons, New York, from 1888 to 1890. He then became lecturer on ophthalmology in Bellevue Hospital Medical College in 1890 and professor of ophthalmology in 1900, until he was appointed emeritus professor in 1921. He was one of the surgeons of the New York Eye and Ear Infirmary from 1890 to 1920. He developed the laboratory of pathology and bacteriology at the Infirmary and, together with Dr. George A. Dixon, devised a method of roentgenologic localization of intraocular foreign bodies.

Dr. Weeks was the author of a well known textbook (A Treatise on Diseases of the Eye, Philadelphia, Lea & Febiger, 1910) and contributed many articles to ophthalmologic publications, usually on clinical and operative subjects; one of the latter was on a method of restoration of the orbital socket.

He was chairman of the Section on Ophthalmology of the American Medical Association in 1905, chairman of the Section of Ophthalmology of the New York Academy of Medicine, president of the American



JOHN ELMER WEEKS
1853-1949

Ophthalmological Society in 1921; president of the New York County Medical Society, and a member of the New York Ophthalmological Society, the Academy of Ophthalmology and Oto-Laryngology, the Ophthalmological Society of the United Kingdom and the Royal Hungarian Medical Society.

He established a scholarship for research work in ophthalmology in the University of Michigan Medical School in 1921, and this college, his alma mater, conferred on him the honorary degree of Doctor of Science in 1934. He received the degree of Doctor of Laws from the New York University and Bellevue Hospital Medical College, and the University of Oregon Medical School elected him honorary professor of ophthalmology.

Dr. Weeks was a man of singular determination and industry, and an unusually dextrous operator, with sound judgment; his quiet self assurance and an infinite capacity for work made him the successful practitioner that he was during the thirty-eight years that he practiced in New York. His opinion and advice were greatly valued by his fellow practitioners, and were particularly in demand at the meetings and discussions which took place. In 1925 he retired from practice in New York city and moved to Oregon.

While continuing his professional work in Portland, Dr. Weeks took great interest in the University of Oregon Medical School and in 1939 donated the necessary funds for a library and auditorium, which are regarded as among the finest in the country. He found congenial opportunity in assisting with advice and financial support in the development of the department of ophthalmology, which was started in 1944 by Dr. Kenneth C. Swan, and one of his donations permitted the foundation of a clinic for binocular vision. The establishment of an ophthalmologic laboratory in this medical school, Dr. Swan writes, was of particular interest to Dr. Weeks, and he frequently compared it to his establishing the laboratory at the New York Eye and Ear Infirmary in 1890. The laboratory in Portland is now completely equipped, and, with its excellent museum, will shortly be moved to larger quarters and will be named in memory of Dr. Weeks.

Dr. Weeks lived long, but never grew old, and to the end retained an ardor and alertness that were envied by all; his modesty, his unfailing equanimity and his superb courage were remarkable. When asked, after he had retired, where he would advise a young ophthalmologist to settle, he replied, "Wherever the competition is the keenest."

He married Miss Jennie Post Parker in 1890; she was his devoted companion and helpmate for the many years of his life and made possible a family life which was singularly happy. Their daughter married Dr. F. R. Mount of Portland, Ore.

ARNOLD KNAPP.

Abstracts from Current Literature

EDITED BY DR. WILLIAM ZENTMAYER

Cornea and Sclera

PENICILLIN IN INTERSTITIAL KERATITIS. J. V. KLAUDER, Am. J. Syph., Gonor. & Ven. Dis. **31:** 575 (Nov.) 1947.

Seventy-two patients, 22 male and 50 females between the ages of 5½ and 46 years, with interstitial keratitis were treated with penicillin. Sufficient time has elapsed to evaluate the results of treatment in 59 of these patients. Forty-one of the 59 patients were given intramuscular injections of 50,000 units of commercial sodium penicillin every four fours for forty-eight consecutive doses in eight days, to a total amount of 2,400,000 units. For the remaining 18 patients the total dose of penicillin ranged from about 500,000 (2 patients) to about 4,000,000 units. The majority received about 2,000,000 units in eight days. Penicillin was well tolerated, without serious untoward reactions. The Herxheimer reaction was absent after initial treatment. Twenty-five patients were given penicillin alone. Nine patients received penicillin combined with eight to twelve inductions of fever with vaccines; 21 patients, penicillin, fever therapy and chemotherapy; 4 patients, penicillin and chemotherapy. In the 25 patients treated with penicillin only, interstitial keratitis progressed favorably or was retrogressing at the time penicillin was given, so that supplemental treatment was not regarded as necessary. Penicillin, like chemotherapy, did not prevent an initial attack of interstitial keratitis, involvement of the second eye or recurrence of the disease in the previously affected eye. The absence of any striking result in the final visual acuity of the penicillin-treated patients is consistent with clinical observation that penicillin does not uniformly exert an immediate favorable effect on active interstitial keratitis. The considerable individual variation in the course of this disease is apparently not altered by penicillin therapy. Interstitial keratitis which was retrogressing at the time of treatment pursued a favorable course, as did mild forms of the disease. An occasional patient with a severe form of the disease seemed to be benefited; such other patients were definitely not improved by penicillin or any other method of treatment. Retreatment with penicillin in refractory cases did not seem to be of benefit. There was no apparent effect after the local use of penicillin. The addition of penicillin to the therapeutic agents for interstitial keratitis does not give results superior to those of other forms of treatment.

J. A. M. A. (W. ZENTMAYER.)

On Results Obtained by Total Conjunctival Hooding of the Cornea for Serpiginous Ulcer. A. Kettesy, Brit. J. Ophth. **32:** 36 (Jan.) 1948.

The procedure consists in covering the whole cornea by a conjunctival flap. The operation is described in detail. Against the objections which have been raised to this method can be set the saving of an eye, or, rather, the saving of vision that would have been lost by any other treatment, and the duration of medical attendance expressed in days of hospitalization.

The average stay in the hospital was four days, and a later stay of three days when the patient returned for removal of the hood, at least six months after the operation. Tables are given showing that in a series of 56 patients treated conservatively, vision was improved in 26, worse in 4 and unchanged in 26, whereas in a series of 56 patients treated by hooding, vision was improved in 45, worse in 1 and unchanged in 10.

Total conjunctival hooding of the cornea is being increasingly employed by Kettesy for keratitic processes. W. Zentmayer.

Interstitial Keratitis and Penicillin. I. Voisin, Bull. Soc. d'opht. de Paris, February 1948, p. 47.

In the case reported, interstitial keratitis had existed in one eye for some time and had appeared in the other eye at the time of the treatment with penicillin, which was given locally, by subconjunctival injection and, generally, by intramuscular injection. The author was impressed with the fact that subconjunctival injection was apparently most efficacious in the acutely inflamed eye. He raises the question whether the penicillin acts as a bacteriostatic or as an antiallergic agent.

L. L. Mayer.

A Case of Nodular Rheumatic Episcleritis. C. Edstrom and G. Osterlund, Acta ophth. **26:** 1, 1948.

A man with chronic rheumatic polyarthritis exhibited episcleral nodules in each eye. Histologic examination of these nodules showed that specific rheumatic tissue changes were present. Material from an excised nodule failed to grow on Loewenstein's substrate and produced no tuberculous changes on being injected into a guinea pig. At autopsy, rheumatic granulomas of the Aschoff type were demonstrable in the myocardium.

O. P. Perkins.

Experimental Pathology

Regeneration of the Corneal Stromal Cells: I. Technique for Destruction of Corneal Corpuscles by Application of Solidified (Frozen) Carbon Dioxide. A. E. Maumenee and W. Kornblueth, Am. J. Ophth. **31:** 699 (June) 1948.

Maumenee and Kornblueth found that freezing various-sized areas of the cornea to — 78 C. for three to five seconds produces a convenient lesion for the study of regeneration of the cells of the corneal stroma.

These lesions do not disrupt the corneal lamellas, are not liable to secondary infection and cause little inflammatory reaction. After the lesions have healed, the cornea is clear. W. S. REESE.

TISSUE RESEARCH AND CELL CULTURE OF THE CORNEA. D. HOOF, Am. J. Ophth. **31:** 709 (June) 1948.

Hoof believes that her preliminary experiments in tissue culture show the possibility of growth of the parenchyma cells out of the substantia propria. Her results would seem to substantiate the theory that the corneal graft lives as an independent tissue within the host's cornea, as advanced by Marchand, Fuchs, Filatov, Castroviejo, Leoz, Ortin, Ascher, Sommer and others. W. S. REESE.

General Diseases

MIKULICZ'S DISEASE AND SYNDROME. P. HEATH, Am. J. Ophth. **31:** 955 (Aug.) 1948.

Heath reports a case of "pure" Mikulicz disease and several cases of enlargements of lacrimal glands due to tuberculosis, sarcoid, gout, syphilis and giant follicular hyperplasia. He discusses the differential diagnosis and states the belief that so-called Mikulicz' disease is probably a granulomatous response of lymphatic tissue of the reticuloendothelial system to a stimulus. W. S. REESE.

XERODERMA PIGMENTOSUM WITH AFFECTION OF THE EYE. J. SÆBØ, Brit. J. Ophth. **32:** 398 (July) 1948.

After a brief description of xeroderma pigmentosum and melanoma in general, Sæbø reports 3 cases in which the eye was involved. In the first case a pterygium-like tumor developed at the age of 15, and lentigenes were present on the skin. The tumor was excised at the age of 17. New growths of the skin which proved microscopically to be malignant were constantly reappearing. The second case was that of a brother of the first patient. He had a history of the presence of brown spots on the face, neck and extremities for many years. At the age of 27 a tumor developed on the neck. In the right eye a vascular spot appeared on the conjunctiva. The familial incidence suggested that the disease was hereditary and was in all probability due to a recessive gene. In a third case of xeroderma pigmentosum a small, whitish tumor of the corneal limbus of the left eye appeared at the age of 10 years. Eight years later the tumor had infiltrated the entire cornea and part of the sclera. The right eye became similarly affected. Both eyes were blind at the age of 20 years and were enucleated. The new growths spread over the entire face, and death occurred one year later.

The author stresses the importance of keeping this disease in mind, even in cases of a seemingly benign tumor in the eye when it appears in conjunction with pigmented spots in the skin. Finally, mention is made of the eugenic measures that should be taken in order to prevent the spread of this serious, hereditary disease. W. ZENTMAYER.

Glaucoma

MILD GLAUCOMA. ADOLPH POSNER and A. SCHLOSSMAN, Am. J. Ophth. **31:** 679 (June) 1948.

Posner and Schlossman remark the mildness of glaucoma in certain cases, in which the fundi, fields and central vision remain unaltered for years. They report 17 of a total of 40 such cases in a series of 373 cases of glaucoma. They suggest that the severity of the disease be determined before miotic therapy is instituted. W. S. REESE.

INTRAOCULAR PRESSURE OF NORMAL AND GLAUCOMATOUS EYES AS AFFECTED BY ACCESSORY LIGHT STIMULI. R. B. ZARETSKAYA, Am. J. Ophth. **31:** 721 (June) 1948.

Zaretskaya studied fluctuations in the intraocular pressure due to light stimuli, especially white or colored light, on the second eye. He suggests that, since green light causes a decided drop in intraocular pressure in glaucomatous patients, advantage might be taken of this therapeutically by use of green spectacles. W. S. REESE.

PROVOCATIVE TESTS AND GLAUCOMA. A. MAGITOT, Ann. d'ocul. **181:** 338 (June) 1948.

The author decries the idea held by many ophthalmologists that increased tension and glaucoma are synonymous.

In many instances, early in the disease the periods of increased tension are transitory. A provocative test would be of great value in diagnosis of incipient glaucoma and of the so-called soft glaucoma. The use of a mydriatic, such as atropine, is not an acceptable method. If the drug produces an acute attack, it is difficult to counteract its effect. The results are also uncertain, since in some cases of glaucoma the tension is not elevated, and it may even be lowered.

Seidel was the first to suggest the darkness test. The subject is kept in darkness for thirty to sixty minutes, and the glaucomatous subject may show an appreciable rise in tension. The author does not believe that the rise in tension is dependent on dilatation of the pupil and embarrassment of the angle. He feels that it is due directly to the action of light on the hypophysis. The result is negative if the diencephalon is not in a stage of excitability.

Another provocative test is the massage or compression of the eyeball. There is first a drop in tension and then a secondary rise. The results are not always reproducible, however.

The use of caffeine, likewise, is not reliable and when tried on known glaucomatous subjects may not cause a rise in tension.

The raising of the venous pressure and the lability test of Schoenberg and Bloomfield are discussed in detail. The author feels that immersion of the hands in cold water may raise the intraocular tension through the thalamic centers and that the vascular response to cold is not significant. He cites the fact that ligation of the jugular veins does not cause an increase in intraocular tension.

In conclusion, the water-drinking test of Schmidt is discussed. This, like most of the other tests, is an attempt to disturb the capillary pres-

sure, since the intraocular pressure varies as the capillary pressure. The author believes that whenever these tests are positive their effect is exerted through the hypothalamic centers.

The results of the tests depend on the state of the diencephalon at the time the test is performed. It must be remembered that an increase in tension is only one of the signs of glaucoma and that the disease may be present despite a normal or subnormal tension.

P. R. McDONALD.

A FAILING DOGMA: OCULAR HYPERTENSION IN GLAUCOMA. M. MARQUEZ, Ann. d'ocul. **181:** 351 (June) 1948.

The author reviews his personal observations on glaucoma and the concepts that have been advanced concerning the etiology of the disease. In the great majority of cases too great importance has been attached to the ocular hypertension. In cases of acute glaucoma the tension is the predominant feature, whereas in cases of chronic simple glaucoma the cupping of the nerve head and changes in the fields are most apparent.

It is evident that in the majority of cases of glaucoma the signs and symptoms of glaucoma and ocular hypertension occur together. There are some cases of glaucoma without hypertension and cases of hypertension wtihout glaucoma. In general, there are two types of glaucoma: the anterior type, which affects the ciliary body and is usually acute, and the posterior type, which affects the nerve and the retina and is usually chronic, and not necessarily accompanied with hypertension. In the latter category may fall cases of cavernous atrophy without field changes or field changes without atrophy.

The present consensus is that ocular tension is not the only factor in glaucoma. In many cases the tension is promptly reduced by operation but the visual defects continue unabated.

It is not enough to treat glaucoma by attempting to reduce the intraocular pressure. One should try to treat the capillaries of the optic nerve. Vasodilator substances or rutin may be tried. The author is of the opinion that in chronic simple glaucoma hypertension is not the cause, but only one of the symptoms.

P. R. McDONALD.

Injuries

TRAUMATIC CYSTS OF THE IRIS DUE TO EPITHELIAL IMPLANTATION. J. A. GALLINO and A. BENJAMIN, Arch. de oftal. de Buenos Aires **22:** 124 (April-June) 1947.

The appearance of cysts in the anterior chamber and stroma of the iris represents one of the least frequent sequelae of perforating traumas of the eye, especially of those which denote a certain amount of violence, such as that in the authors' case. They express the belief that the history in this case entirely confirms the theory of migration and implantation of the corneal epithelium, in view of the large number of cysts of every size which were found implanted in the iris and free in the anterior chamber.

M. E. ALVARO.

Ocular Muscles

ANATOMIC FACTORS IN THE ETIOLOGY OF HETEROTROPIA. RICHARD G. SCOBEE, Am. J. Ophth. **31:** 781 (July) 1948.

Scobee discusses the anatomic factors which he believes are responsible for 90 per cent of all cases of heterotropia appearing in the first six years of life. He classifies the causes of heterotropia as follows: (1) anatomic: (*a*) abnormal origins of muscles, (*b*) abnormal insertions, (*c*) abnormal muscle slips, (*d*) abnormal check ligaments, (*e*) abiotrophies; (2) innervational: (*a*) nervous (anomalies of convergence and divergence), (*b*) refractive (accommodative), (*c*) amblyopic (any organic obstacle to fusion); (3) paretic: (*a*) toxic, (*b*) traumatic, (*c*) congenital.

W. S. REESE.

A TECHNIQUE FOR MUSCLE RESECTION WITHOUT THE USE OF THE PRINCE FORCEPS. E. YASUNA, Am. J. Ophth. **31:** 972 (Aug.) 1948.

Yasuna describes a simple technic for muscle resection in which a double-armed suture is placed near the insertion of the muscle and then beyond it and the intervening tendon resected, ordinary forceps being used instead of the Prince forceps, which he considers unsafe.

W. S. REESE.

Operations

FURTHER EXPERIENCES WITH INTEGRATED EYES AND VITALLIUM IMPLANTS. W. L. HUGHES, Am. J. Ophth. **31:** 854 (July) 1948.

Hughes describes an operation in which he uses a vitallium® implant with an aperture to provide for fixation of an artificial eye. He makes a preliminary report on 5 cases.

W. S. REESE.

OCULAR SURGERY. FELICIANO PALOMINA DENA, An. Soc. mex. de oftal. y oto-rino-laring. **21:** 88 (April-June) 1947.

Palomina Dena states that corneal grafting and the technic of keratectomy have progressed until they are now perfected and give satisfactory results. The intracapsular cataract operation offers the greatest security. In the present treatment of retinal detachment localization of a tear is unnecessary. Strabismus is no longer fundamentally a surgical problem. Glaucoma continues to be the chief problem in ophthalmology, and until the etiologic and pathogenic factors are determined, surgical treatment will be symptomatic, and the disease will remain as an important cause of blindness.

M. E. ALVARO.

The Pupil

TONIC PUPIL PRODUCED BY THE RETROBULBAR INJECTION OF ALCOHOL. R. WEEKERS, Ann. d'ocul. **181:** 193 (April) 1948.

The retrobulbar injection of alcohol is an accepted method of treating pain in the eyeball. The injection of 1.5 cc. of a 40 to 50 per cent alcohol has no effect on the retina or the optic nerve. The only compli-

cation previously described was a transitory paresis of the ocular muscles. The author has seen persistent changes in the pupillary reactions following the procedure. These changes have led to interesting speculation concerning the pathogenesis of Adie's syndrome.

The pupillary changes were noted in 4 patients, 3 men and 1 woman. These alterations did not follow an excessive injection of alcohol. Three stages were noted in the pupillary disturbances: 1. The pupil was dilated and did not react to light or in accommodation. This stage lasted several weeks. 2. The pupil was dilated and did not react to light. The reactions in accommodation and convergence were present, and recovery was very slow. In this stage the pupillary reaction simulated Adie's syndrome. In time the third stage was noticed. 3. The pupil was dilated and appeared to be fixed to light; however, with the slit lamp a faint response to light was noted. The accommodation-convergence reaction was still tonic. This stage may remain for years.

In attempting to explain the pharmacodynamics of this pupillary abnormality, the effects of several drugs were investigated. The affected eyes were shown to be sensitive to methacholine, as first demonstrated by Adler and Scheie. The author believes that the tonic pupil following the retrobulbar injection of alcohol is produced by a lesion of the iridoconstrictor (parasympathetic) fibers in the orbit.

P. R. McDonald.

Retina and Optic Nerve

The Present State of the Problem of Retinitis Pigmentosa. I. Biro', Brit. J. Ophth. **32**: 411 (July) 1948.

It is evident that typical retinitis pigmentosa, in the majority of cases, is not an independent ophthalmic disease but a manifestation of a widely branching complex, the nucleus of which is the pathologically altered functions of the pituitary and the diencephalon and the hormonal consequences thereof.

The author emphasizes the dual pathogenesis of the disease, as described by Redslob, namely, (1) inherited, and (2) *"sui generis,"* or "autonomous." The inherited type is further divided into the recessive type and that inherited as a dominant.

In contradistinction to the hereditary form, the autonomous form is a sequel of such diseases as the acute exanthems, inflammations, toxic diseases and permanent circulatory impairment; and the hereditary and autonomous forms have certain clinical differences. The autonomous form is not without the possibility of permanent improvement, but no treatment can be expected to influence the inherited disease.

W. Zentmayer.

Prognosis of Retrobulbar Neuritis. W. F. T. Tatlow, Brit. J. Ophth. **32**: 488 (Aug.) 1948.

The purpose of the investigation was to discover in how many cases of retrobulbar neuritis disseminated sclerosis eventually developed, after a number of years. Tatlow summarizes his study as follows: The

records of 46 patients with retrobulbar neuritis were taken from the hospital files. Eleven patients were not traced; 4 were dead, and 1 refused examination. The remaining 30 patients were examined from ten to forty-seven years later. Twelve patients were found to have abnormal neurologic signs apart from those referable to the eyes, but only 1 was bedridden with disseminated sclerosis. The eventual prognosis of visual recovery was good. Of the 24 patients with unilateral involvement, 1 was blind; and of the 6 with bilateral disease, 2 were blind in both eyes and 2 were blind in one eye. The importance of examination of cerebrospinal fluid for evidence of syphilis in cases of retrobulbar neuritis is stressed.

W. ZENTMAYER.

RETINAL CHANGES WITH ACUTE REDUCTION OF VISION AS INITIAL SYMPTOMS OF INFECTIOUS MONONUCLEOSIS. G. KARPE and P. WIEING, Acta ophth. **26:** 19, 1948.

A case of infectious mononucleosis is reported in which an edematous swelling, about 7 D. in elevation, developed in the macular region of the retina of one of the patient's eyes. On recovery of the patient, the swelling subsided, leaving only scattered granules of retinal pigment as an aftermath, with no evidence of underlying choroiditis. This case is regarded as further evidence that infectious mononucleosis possesses a certain neurotropism, in addition to an affinity for the lymphatic organs.

O. P. PERKINS.

PERIPHLEBITIS RETINAE AND ITS RELATION TO THE PRIMARY TUBERCULOUS INFECTION. M. HAARR, Acta ophth. **26:** 41, 1948.

A survey of the clinical picture of periphlebitis retinae is given. Four cases are reported, in which the disease seems to have developed in connection with a primary tuberculous infection elsewhere. It is therefore emphasized that periphlebitis retinae is not an isolated ophthalmic disease but, rather, a localized manifestation of a systemic process. The disease is closely related to erythema nodosum. Other localizations of a perivascular process may occur, such as in the central nervous system, joints, pleura and kidneys.

O. P. PERKINS.

RETINITIS PIGMENTOSA WITH SPECIAL REFERENCE TO OTOLOGIC, NEUROLOGIC AND ENDOCRINE COMPLICATIONS. E. KJERRUMGAARD, Acta ophth. **26:** 55, 1948.

The author presents a statistical survey of 150 cases of retinitis pigmentosa in several institutions for the blind. Various ocular, otologic, neurologic and endocrine complications, or concomitant findings, are discussed. The author stresses that, though developmental anomalies may be of very different natures and be localized in widely different parts of the body, they may still be the result of one lesion affecting a gene, or group of genes, at a given time in embryonic development.

O. P. PERKINS.

Tumors

A Myxo-Haemangioma Simplex of the Conjunctiva Bulbi. A. Bakker, Brit. J. Ophth. **32:** 485 (Aug.) 1948.

A rapidly growing, finger-like tumor with a broad, short pedicle was removed from the bulbar conjunctiva of the right eye in a woman aged 35. The tumor had a cherry red color and a smooth surface and was surrounded by a thin fibrous capsule. The diagnosis was hemangioma simplex of the conjunctiva bulbi with signs of intensive proliferation and myxomatous degeneration.

W. Zentmayer.

Indications for Contact Radiotherapy in Treatment of Tumors of the Lids. F. Baclesse and A. Ennuyer, Arch. d'opht. **7:** 5, 1947.

The authors report a review of 200 cases. They first describe the procedure involved with the use of a contact radiotherapy machine designed by Philips. A number of photographs, showing conditions before and after treatment, accompany the article. The tumors for which this treatment is indicated are many. Epitheliomas and angiomas of the lids are the most frequent. The method is also of equal value in the treatment of epitheliomas of the cornea. In the authors' experience, no late ocular damage has been observed. The technic constitutes the best protection for the eye. It also allows the ambulatory treatment of a large number of patients.

S. B. Marlow.

Sympathicoblastomas with Metastases to the Orbit. H. Olesen and F. Sjøntoft, Acta ophth. **26:** 67, 1948.

The authors give a lucid description of the genesis, pathologic characteristics and symptoms of sympathicoblastomas. They stress the difficulty of differential diagnosis, particularly from chloroma. Two cases are reported, with photomicrographs of the tumor.

O. P. Perkins.

Uvea

Contribution to Data on Sight Disturbances Caused by Proliferation of Pigment Epithelium. M. Radnót, Brit. J. Ophth. **32:** 423 (July) 1948.

Radnót states that serious disturbance may be caused by proliferation of the pigment epithelium of the iris in the case of after-cataract resulting from the deposit of pigment on the surface of the remaining capsule. The author describes the case of a woman aged 83 in whom, after an intracapsular extraction with a round pupil, the surface of the vitreous was covered with a pigment layer, similar to the so-called *Pigmentnachstar.*

W. Zentmayer.

Operative Treatment of Five Cases of Iridodialysis. S. Gördüren, Brit. J. Ophth. **32:** 429 (July) 1948.

Gördüren employs a slight modification of Golowin's operation for the correction of iridodialysis. A keratome incision is made just at the level of the root of the iris and parallel to its anterior surface. The

knife is slowly withdrawn, and the root of the iris is allowed to come between the lips of the incision with the outflow of aqueous; then, with two spatulas, slight adjustments are made to keep the root of the iris evenly in the lips of the wound. Atropine is instilled, and both eyes are bandaged. In 3 of the cases the iridodialysis was corrected. A deep groove was left in the margin of the pupil. W. ZENTMAYER.

Visual Tracts and Fields

WIDENING OF THE ANGIOSCOTOMA IN THE ALARM REACTION. M. R. CHOLST, Am. J. Ophth. **31**: 821 (July) 1948.

Cholst gives the following summary:

1. In this study the effect of alarm on the angioscotoma and on the possible physiologic mechanism involved is presented.

2. A widening of the angioscotoma was demonstrated in the 3 cases studied; the scotoma gradually returned to normal shortly after the cause was removed.

3. This effect of fright might be a source of error in the mapping of the blindspot when routine central scotometry is performed on subjects in an apprehensive state. W. S. REESE.

BITEMPORAL VISUAL FIELD DEFECT IN AQUEDUCT STENOSIS. M. BARDRAM, Acta ophth. **26**: 25, 1948.

The author reports 2 cases of stenosis of the aqueduct in which papilledema and bitemporal field defects were evident. Ventriculographic studies demonstrated a distended third ventricle pressing down into an expanded sella. Hence it is important to consider the possibility of a lesion in the posterior fossa when one is confronted with this combination of signs. O. P. PERKINS.

Book Reviews

Sulla teoria delle aberrazione monochromatiche nell'occhio umano. By G. Carlevaro Parma, M.D. Pp. 160, with 153 illustrations. Torino, Italy: Resenberg and Sellier, 1943.

This book gives a thorough exposition of the work of von Helmholtz, Tscherning and Gullstrand on the subject of monochromatic aberrations of the eye. Of the three parts, the first is devoted to the presentation of the elements of mathematics necessary to a consideration of the algebraic, geometric and trigonometric aspects, presented in the other two parts. The second part is also introductory in content, since it deals with theories and laws and their application to image formation in general.

Part three contains the author's exposition of the subject, together with his original contributions to it. Keratoscopic findings with the Gullstrand mire permit the classification of corneal asymmetries into three groups, according to the distortion of the corneal reflex in the various meridians and the decentration of the pupil. By a method of subjective stigmatoscopy, the authors and two other subjects made their observations, which are reproduced to show in various cross sections the caustic curve as it is projected on the retina by changing the focus of the eye with lenses placed before it. Thus the composition and distribution of light rays emitted by a luminous point are analyzed as they are refracted in the eye.

The author further discusses, in relation to spherical aberration, decentration of the pupil and of the corneal optic zone, and the path of rays in the astigmatic eye. The application of objective stigmatoscopy and ophthalmoscopy to the problem of monochromatic aberrations of the eye is briefly presented.

The book is carefully planned and presented and yet is easier to follow than is usual with so complete a presentation of this difficult subject.

JOSEPH J. LO-PRESTI.

Transactions of the Pacific Coast Oto-Ophthalmological Society, San Francisco, 1948.

This is the report of the thirty-second annual meeting of the Pacific Coast Oto-Ophthalmological Society, which is patterned after the Academy of Ophthalmology and Otolaryngology. The meetings were held June 7, 8, 9 and 10, 1948, in Seattle. Instructional courses and scientific papers on both ophthalmology and otolaryngology were delivered. A list of papers presented on ophthalmology and their authors follows: "The Roentgen Ray Treatment of Uveitis," Moacyr E. Alvarado, M.D.; "Thyrotropic Exophthalmos: Report of Three Cases Treated Medically," Clarence A. Veasey Jr., M.D.; "Lighting and Visual Efficiency," James R. Powell, M.D.; "Divergence Insufficiency as a Practical Problem," L. Weston Oaks, M.D.; "Accommodative Defect Following Atmospheric Concussion," Homer E. Smith, M.D.; "The Corneal Lens; a New Type of Plastic Contact Lens: A Preliminary Report," Maurice W. Nugent,

M.D.; "Cyclodiathermy—Indications, Technic and Results," Andrew de Roetth, M.D.; "Some Tumors of the Iris," Charles W. Browning, M.D., and Kenneth C. Swan, M.D.; "Hemorrhage Into the Anterior Chamber in Nonperforating Injuries," Robert C. Laughlin, M.D.

FRANCIS HEED ADLER.

Elementos de cirurgia do cristalino (Tratamento cirurgico da cataracta). By A. Lopez d'Andrade, Director of the Institute of Ophthalmology of Dr. Gamma Pinto, Professor of Ophthalmology in the Faculty of Medicine of Lisbon, Portugal. Bertrand Brothers, 1947.

This is a practical treatise on the surgical treatment of cataract as carried out in the Institute of Ophthalmology of Dr. Gamma Pinto in Lisbon. It concerns the author's technic primarily, rather than a review of the literature. There are a brief chapter on the embryology and anatomy of the lens and good chapters on the indications for operation for the usual type of cataract and for various atypical forms. The operations are well illustrated with photographs and drawings. There is a good section on postoperative complications and their treatment.

FRANCIS H. ADLER.

Malattie cutanee e veneree ed alterazione oculari. By G. Sala and P. Noto, with foreword by Prof. A. Crosti and Prof. B. Alajmo; Edited by S. F. Flaccovio. Price, 1,500 lire. Pp. 410. Palermo, Italy, 1948.

This volume, by an ophthalmologist and a dermatologist, is an important Italian publication, showing the close relation of these two branches of medicine. The authors did not limit their observations to the diseases of the skin surrounding the eye, but made a complete clinical and pathologic study of generalized diseases of the skin affecting the interior of the eye. The volume, of 410 pages, is divided into sixteen chapters, including "Epithelial Dystrophies," "Allergic Dermatoses," "Dermatoses Due to Parasites," "Infection and Avitaminoses," "Precancerous Lesions," "Hemorrhagic Syndrome" and "Venereal Diseases."

A large bibliography completes this interesting and well written book, for which the authors deserve a great deal of credit.

VITO LA ROCCA.

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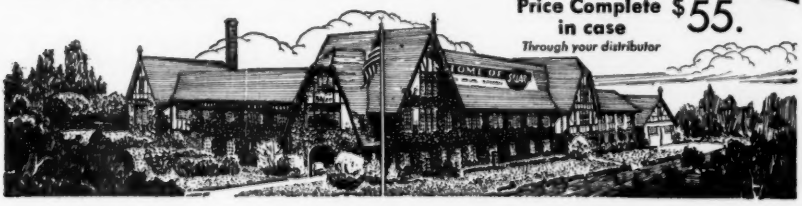

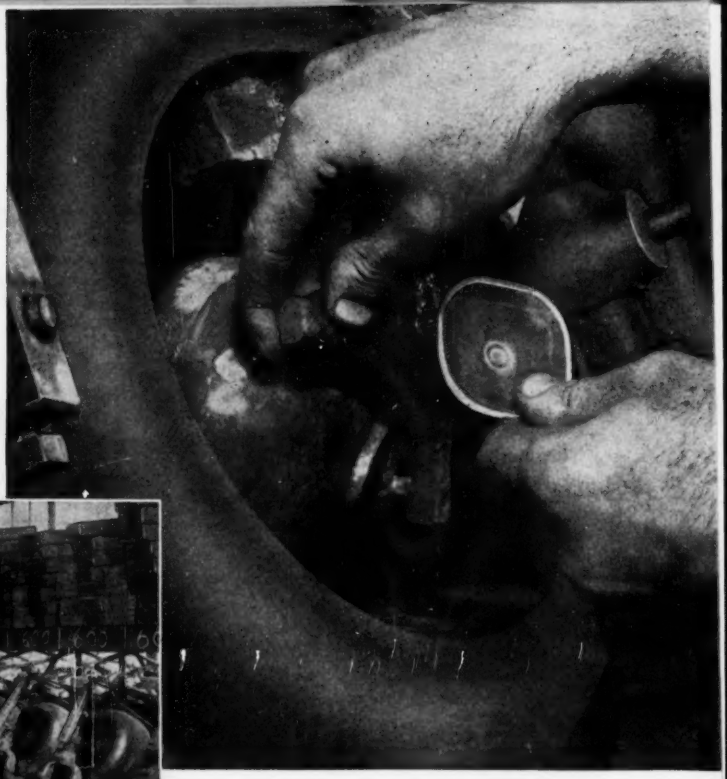

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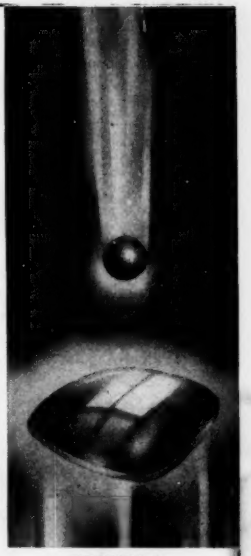

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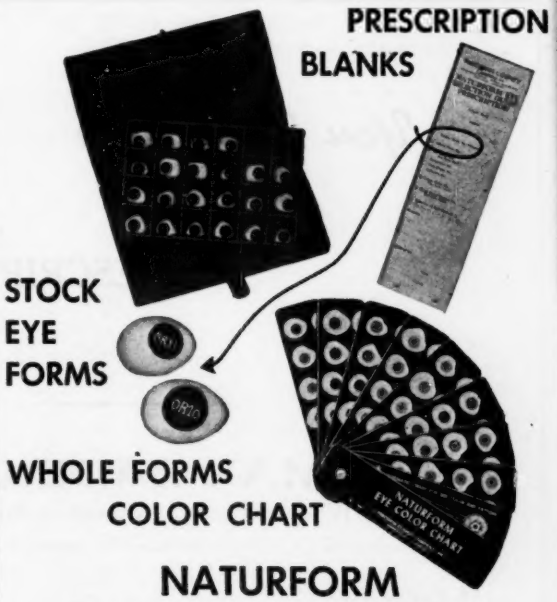

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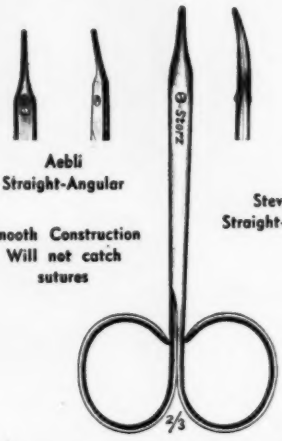

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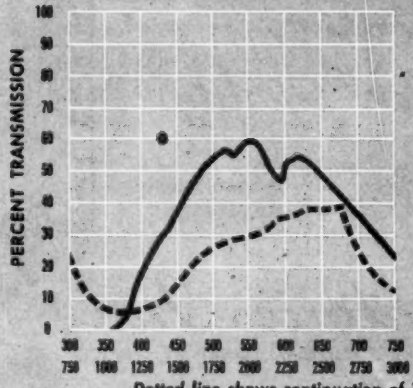

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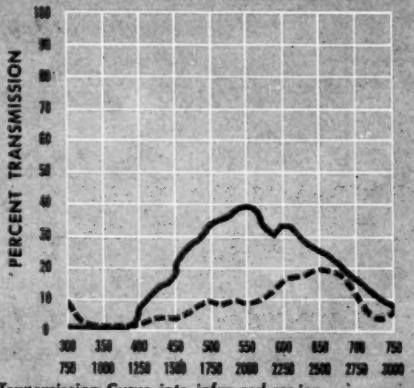

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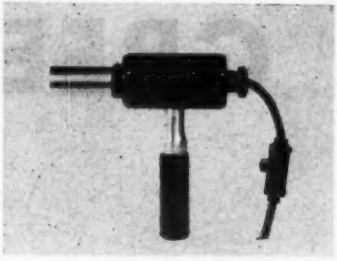

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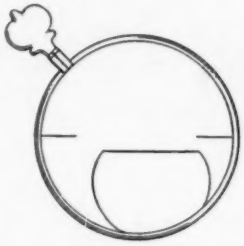

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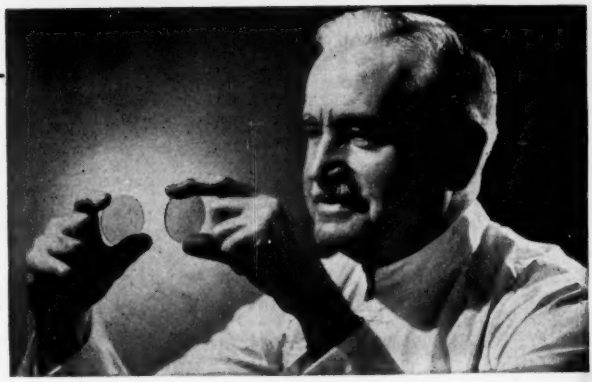

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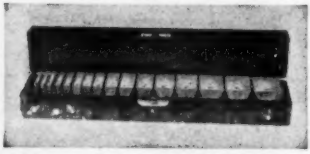

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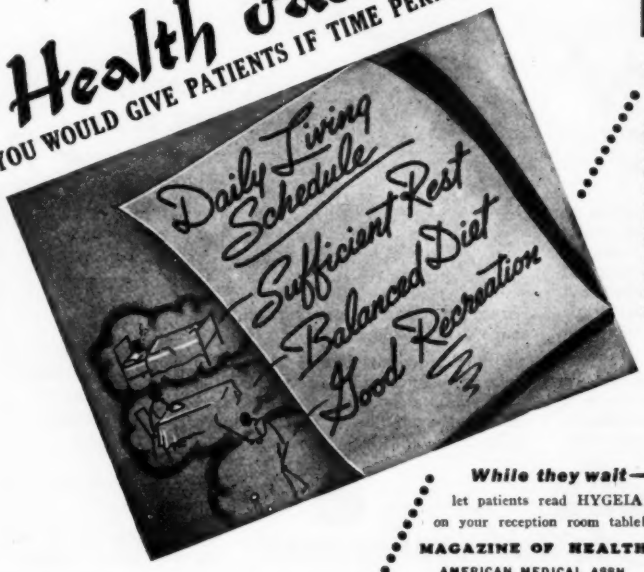

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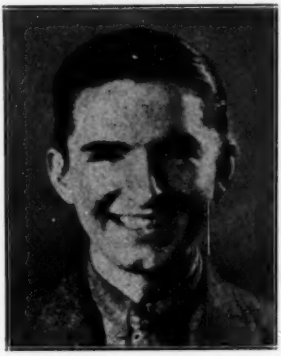

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